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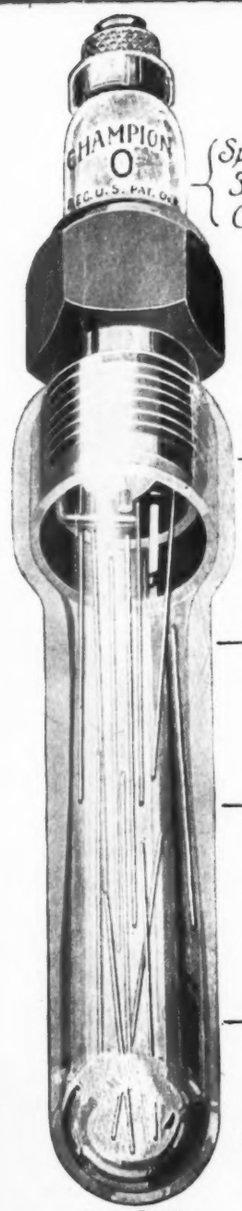

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The operation is so simple a child can do it.

The plug itself does not even have to be taken apart.

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CHAMPION
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SPARK PLUG CLEANER

A whole set of plugs can be cleaned with a Champion "Minute" Cleaner in less time than it formerly took to get ready to do the task.

All you have to do is fill the tube half full of gasoline—screw the plug into the bushing at the end—and shake.

The gasoline dissolves the oil, and the needles in the tube pick the carbon clean from the porcelain. That's all there is to it.

Dealers are finding the Champion "Minute" Spark Plug Cleaner a real money maker. It's brand new and every motorist wants one. Better order your stock today.

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Stewart PRODUCTS

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Warning Signal

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Warning Signals

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Stewart
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There Is Money In Accessories

Put your accessory business on a big paying basis. You can easily do it. Make your accessory department the most profitable by handling only standard accessories of known value, accessories that virtually sell themselves.

Stock up with Stewart Products. They are best known, most advertised, and easiest to sell.

As a Stewart dealer, you tie to Stewart success and Stewart advertising—both the biggest in the accessory field. You get added prestige and an accessory business that's decidedly worth while.

And remember, Stewart Products make the hardest competition.

Take the Stewart Tire Pump for instance. It is standard equipment on many of the best cars. It is the one tire pump recognized by the motor car industry. Consequently, it is the easiest to sell—and hardest to compete with.

The same is true of the Stewart Warning Signals, Stewart Vacuum System, Stewart Speedometer, V-Ray Spark Plugs—and all other Stewart Products, including the famous combination Stewart Speedometer and Instrument Board for Fords, selling for $11.25.

Don't waste your time, money and efforts trying to sell unknown, unadvertised accessories.

"It will pay you to see that every car is Stewart equipped."

Stewart-Warner Speedometer Corporation

Chicago U. S. A.

$12

Stewart
Tire Pump

$50

Warner
Auto-Meter

The Automobile

Vol. XXXVI New York—Thursday, March 15, 1917—Chicago No. 11

S. A. E. Council in Session

Decides To Continue Mileage for Standards Committee—Campaign for 1000 New Members

Atlantic City, N. J., March 13—*Special Telegram*—At a special 2-day session of the Council of the Society of Automobile Engineers held at Hotel Traymore here yesterday and to-day many matters of prime importance to the Society were accomplished.

It was decided to continue the payment of mileage to members of the Standards Commiteee when attending its meetings.

Under the direction of the membership committee a campaign for 1000 new members during the month of April has been started. Sub-membership committees are being formed in nearly forty cities and a canvass made of all factories for eligibles. Twenty applications for membership were received, eight for associate membership and twelve juniors for student enrollment. Among those applying for membership were Col. Charles Clifton, for years president of the National Automobile Chamber of Commerce, and two well-known racing drivers, Dario Resta, A. A. A. racing champion of last year, and Grover E. Ruckstell.

In connection with its standardization work the transmission and engine division was divided into two divisions, one on engines and the other for transmissions.

A. W. Copland was appointed chairman of the transmission division with Eric Wahlberg, B. F. Wright, L. C. Fuller, H. J. Garceau and J. E. Gramlich to assist him. The engine division consists of W. T. Fishleigh, R. J. Broege, W. A. Frederick, E. G. Gunn, H. L. Horning, A. F. Milbrath, H. C. Snow, Charles Balough and G. W. Smith, Jr. Other changes made were the appointment of Bruce Ford who was appointed chairman of the Starting battery division and W. H. Palmer, Jr., chairman of the electric vehicle division.

The 1917 meetings committee expects to announce next week what place has been selected for the Summer meeting in June.

Practically a full meeting of the council was present, those in attendance being: President George W. Dunham, Jesse G. Vincent, Charles M. Manly, Benjamin B. Bachman, H. L. Horning, David Beecroft, Charles W. McKinley, Fred E. Moskovics, John G. Utz, C. F. Clarkson and Herbert Chase.

—

National Prices Raised $100

New York, March 10—The National Motor Vehicle Co., Indianapolis, has raised its prices $100 to-day. In the Sixes, the following prices will prevail: Roadster, touring car, and phaeton, $1,850; coupé, $2,500, and Springfield body, $2,450. In the Twelves the new prices are: Roadster, touring car, and phaeton, $2,250; coupé, $2,900, and Springfield body, $2,850.

—

Hupp Increases Prices $100

Detroit, March 14—The Hupp Motor Car Co. has increased its prices $100 on all open models. The five-passenger touring car is now $1,285, two-passenger roadster $1,285, and the seven-passenger touring is now $1,440. The five-passenger sedan is still selling at $1,735.

—

Kelly-Springfield Tire Re-Elects Directors

New York, March 8—The Kelly-Springfield Tire Co. directors were re-elected at the annual meeting yesterday. The directors are as follows: Van A. Cartmell, F. A. Seaman, Stephen Peabody, O. R. Cook, A. L. Scheuer, J. Oppenheim, A. M. Poole, and B. Maas.

—

Remy Re-Elects Directors and Officers

Detroit, March 14—At a meeting of the stockholders of the Remy Electric Co., all directors and officers were re-elected.

Overland Earns $5.71 Per Share

Earnings $10,016,420 Compared with $11,201,255 in 1915—22.85% on Common

Toledo, Ohio, March 14—Net earnings equal to $5.71 a share are reported by the Willys-Overland Co. for 1916, which was the biggest year in the history of the company in point of sales. Approximately 150,000 Overland and Willys-Knight cars were sold, a net gain of more than 40 per cent over 1915.

The report shows net earnings of $10,016,420, after allowing for the following deductions: $1,049,141 for repairs and maintenance, $951,379 for renewals and depreciation, $1,028,133 for tool replacement and other reserves. This figure of net is exclusive of the profits on shipments to distributing branches which were unsold Dec. 31, amounting to $1,318,665. Adding this latter item to make comparison of the 2 years on an equitable basis, net earnings in 1916 of $11,335,075 compared with $11,201,255 in 1915. Net income for the year carried to the balance sheet is $9,565,719, after deducting $450,701.73 interest on indebtedness from the $10,016,420 net earnings.

Net earnings of $10,016,420, without including the $1,318,665 on shipments to branches unsold at the end of the year are equivalent to 22.85 per cent on the $37,273,844 common stock outstanding Dec. 31, after allowing full 7 per cent dividends on $15,000,000 preferred.

In 1915 the net earnings of $11,201,255 were equivalent to 46.76 per cent on the $21,000,000 common stock outstanding in that year.

John N. Willys, president, states:

"An important change was made during the year in the method of distribution of our products. At many important cities we took over the business of distribution from outside agencies and established our own branches. This had an important effect on

(*Continued on page* 546)

Quinby Retires From Business

Pioneer Body Builder To Sell $400,000 Factory—Future Plans Undecided

NEWARK, N. J., March 9—J. M. Quinby & Co., one of the oldest carriage and automobile body builders in this country, has decided to retire from business, after a period of 80 years of body building. With the retirement of this company one of the pioneer builders of automobile bodies leaves the industry. This company started building automobile bodies as far back as 1900 and was one of the first to use aluminum in their construction. When it was found that aluminum could be used in the construction of bodies, the Quinby company sent a representative over to Europe to study its practicability and as a result has since manufactured its bodies with that metal.

The company has specialized in high class body work, doing a large part of the body business for foreign cars. Much of the special body work on Simplex cars has come out of this factory.

From time to time the company has planned entering the automobile manufacturing field and the present retirement may be a step toward that end.

The company has put its $400,000 plant on the market and is cleaning up all its business, refusing new orders. According to plans it will sell the plant with or without the good will of the business.

The company is capitalized at $200,000 and the officers are: President, W. W. Ogden; vice-president and treasurer, H. D. Ogden.

—

Bissell with Detroit Steel Products

DETROIT, March 12—R. Bissell, for the last 3 years research engineer for Dodge Brothers, has joined the spring department of the Detroit Steel Products Co. in a similar capacity. Mr. Bissell, who is a graduate of the engineering department of the Michigan Agricultural College, is a member of the American Society for Testing Materials, Steel Treating Research Club, and many other organizations.

—

Gasoline Price Investigation Near

WASHINGTON, D. C., March 13—The long-deferred report of the Federal Trade Commission's investigation of increased gasoline prices will be made within the next 2 weeks, according to reliable information to-day. While government officials are reticent about conclusions arrived at by the commission, it is rumored that the report will score the Standard Oil Co. on the ground that the thirty constituent companies have not been wholly dissolved, despite the Supreme Court decree.

The Trade Commission has discovered in the course of its inquiry that various big oil and gasoline companies have been selling all grades of gasoline for the same price, except in a few States, and these States the ones which have already adopted laws for the standardization of gasoline.

As a result of this discovery, the coming report of the Commission is expected to point to the good results from State standardization laws as justification for its recommendations that the Federal government take similar action.

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To Test Packard Aero Engine

DETROIT, March 14—The Packard Motor Car Co. will install its new aeroplane engine in an aeroplane and test it by flight at Joy Field within 2 weeks.

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Myers Is Doble Vice-President

DETROIT, March 8—T. P. Myers, general sales manager and director of the General Engineering Co., maker of the Doble steam car, has been elected a vice-president of the company.

—

Hupp Resigns from Emerson

NEW YORK, March 9—R. C. Hupp has resigned as vice-president, director and chief engineer of the Emerson Motors Co., having completed the work of designing and building the first Emerson cars, production of which is now going forward in the company's plant at Kingston, N. Y.

Mr. Hupp has opened an office in Long Island City, where he is at work on new plans to be announced later. Mr. Hupp was formerly connected with the Oldsmobile, Ford, Regal, Hupmobile, R. C. H. and Monarch companies.

—

Carmody American Production Manager

NEW YORK, March 12—J. A. Carmody has succeeded J. C. Spears as production manager of the American Motors Corp., Plainfield, N. J. At a special meeting recently in Richmond, Va., the following were elected officers of the company; president, W. H. Hoople; vice-president, Louis Chevrolet; treasurer, G. F. Baright; and secretary, P. W. Hansl. Mr. Carmody was formerly chief engineer of the Wagner-Ward Leonard Co., and was consulting engineer of the General Electric Co.

—

Ramey Ever Ready Battery Sales Mgr.

LONG ISLAND CITY, March 8—Col. H. B. Ramey, who for the past 2½ years has been district manager of the storage battery division of the American Ever Ready Works' Chicago branch, has been appointed sales manager of the entire storage battery division.

Exporter To Build Cars

American Motors, Inc., Will Produce Amco Designed by D. M. Eller

NEW YORK, March 9—Predicting a big market for American automobiles adapted to foreign use, the American Motors, Inc. has decided to increase its scope by invading the automobile manufacturing field with an assembled car called the Amco. The American Motors, Inc. was recently formed to serve the automobile makers in their foreign business by a comprehensive plan of coordination, embracing every step in the transfer from the American maker to the foreign buyer of automobile products. The manufacturing branch of the business will be carried on in conjunction with its export service and will be under the direct supervision of the present officers.

The company's designer, D. M. Eller, is now experimenting with a car particularly adapted to foreign use. For instance, the radiator will be much larger than the standard sizes. The company is using a 4-in. core Mayo radiator, which, it states, will eliminate much of the overheating troubles of American cars in certain foreign countries.

Though the specifications have not all been decided upon, it is known, however, that a four-cylinder Continental motor will be used and that the car will be designed so as to embrace most of the European standards, as well as the American.

The company has forty-one foreign branches to take care of this business and has already received many inquiries for agencies in the United States.

Mr. Eller has made a special study of the European needs. His plan is to build only the chassis and to ship them knocked-down, so as to economize on the shipment rates and to cut down much of the extra cost on the chassis after it reaches a foreign port. He states that the body work will be taken care of through the branches. Mr. Eller will visit Europe as soon as the war stops when he will line up his branches so as to take care of the 7000 or 8000 cars he expects to produce at maximum production.

No definite plant location has as yet been decided upon. The company, however, will establish its plant on the Atlantic Coast.

—

Myers Consults with War Department

DETROIT, March 9—Cornelius T. Myers, consulting engineer, has been called to Washington, D. C., for consultation with the war department on military engineering matters.

Detroiter M. C. Co. in Merger

$4,000,000 Concern Will Include Two Parts Cos.—Bamford President

DETROIT, March 12—The Detroiter Motor Car Co. will be taken over by the Detroiter Motors Co., a new $4,000,000 corporation, this week in company with two automobile parts companies. The names of the parts companies are at this time being withheld from the public owing to details which are yet to be completed. Plans have been arranged for the expansion of the Detroiter output and it will be increased from 2000 to 5000 cars yearly.

J. S. Kuhn, New York banker, has been active in the financing of the new company and will become vice-president. A. O. Dunk, president of the Detroiter Motor Car Co., will become chairman of the executive board of the new corporation. W. R. Bamford, vice-president of the old company will become president; W. L. Heuser will be re-elected secretary, W. L. Van Deusen, sales manager and R. T. Yeats, director of export sales will continue with the new company in the same capacities.

Election of officers and completion of details will take place in New York on March 15.

The Detroiter company came under the direction of Mr. Dunk in July, 1915 and comprises a plant of 150,000 sq. ft. which will be increased to 600,000 sq. ft. in the near future. At a later date the company expects to purchase land in Detroit and will then build a factory of 800,000 sq. ft.

To Make Cars in Salt Lake City

SALT LAKE CITY, UTAH, March 10—C. A. Cawley has constructed an automobile for which a company will be organized and which will be manufactured in this city. The car is designed to meet western requirements and is of 41 hp., four-cylinder and five-passenger capacity. It will sell for $985.

Halladay Motor Car Co. Formed

MANSFIELD, OHIO, March 9—The Halladay Motor Car Co. has been incorporated with a capital of $1,000,000 to manufacture automobiles. The incorporators are T. E. Huth, Y. F. Stewart, J. N. Horne, Geo. B. Stacey and E. D. Baxter.

Hope for Webb Bill

WASHINGTON, March 10—The calling of a special session of Congress for April 16, has aroused hope on the part of friends of the Webb bill for combinations of American exporters abroad that it might yet become law. The President, it is believed, will refer to this measure in his message to the special session of Congress.

Corbitt Adds ¼ and 1-Ton Models

ANDERSON, N. C., March 10—The Corbitt Automobile Co. has added two models, a ¾-ton and a 1-ton, to its line of trucks. The new types are similar to the 1½, 2, 2½ and 3½-ton models in general design.

Both new trucks have wheelbases of 130 in., 3¾ by 5 in. four-cylinder engines, worm drive and gear ratio in high of 6½ to 1. Front tires on the ¾-ton are 34 by 3 and rear tires 34 by 3½. On the 1-ton 34 by 3½ in. tires are used in front and 34 by 4 in the rear. The smaller model sells for $1,100 and the 1-tonner for $1,300.

Metropolitan Product Is Mackbuilt

NEW YORK, March 14—The 1500-lb. truck made by the Metropolitan Motors, Inc., this city, is named Mackbuilt after W. C. Mack, president of the company and formerly of Mack Bros.

The Mackbuilt is made in a single chassis of conventional design with a wheelbase of 115 in., a 3¾ by 4¼-in. four-cylinder engine, bevel drive and pneumatic tires. Front tires are 34 by 4 and rear 35 by 4½. The truck is designed for fast delivery work, has a gear ratio in high of 6 to 1 and sells for $895.

Menominee Truck Changes Prices

MENOMINEE, MICH., March 13—A change in prices on five models of Menominee trucks has been announced by the Menominee Motor Truck Co. These changes are as follows:

Model	Old Price	New Price
E W	$1,295	$1,245
F W	1,575	1,790
H.	1,775	2,050
D.	2,250	2,475
G.	2,775	3,275

Denby Changes Prices

DETROIT, March 12—The Denby Motor Truck Co. has changed the prices of its products. The 1-ton model R now sells for $1,275; 1½-ton model G sells, chassis only, for $1,775; 2½-ton model K, chassis only, sells for $2,150.

The company is planning to triple its capacity.

Commerce Prices Raised $100

DETROIT, March 14—The Commerce Motor Car Co. has raised its prices $100 on account of the high prices of materials. The change is effective to-day. The 1-ton model, formerly selling at $1,140 now lists at $1,240 and the ¾-tonner, formerly at $875 is now priced at $975. Another ¾-ton model is now listed at $1,075.

G. M. C. Common on 12% Basis

95,533 Cars and Trucks Sold in 7 Months—Gross Sales Total $102,930,670

NEW YORK, March 10—The General Motors Corp. of Delaware yesterday declared a quarterly dividend of 3 per cent on its common stock. The last dividend on the common stock, declared 3 months ago, was 1 per cent, or at the annual rate of 4 per cent. The dividend just declared is at the annual rate of 12 per cent. The board of directors of the General Motors Co. of New Jersey has declared a regular quarterly dividend of $15 a share on its common stock, establishing an annual dividend rate of $60 a share on its common stock. The dividends of both companies are payable May 1 to stock of record April 12.

The General Motors Co. of New Jersey has sold during the 7 months ended Feb. 28, 1917, 95,533 cars and trucks, as compared with 73,057 cars and trucks for the same period a year ago.

The gross sales for these two periods are respectively $102,930,670, as against $86,675,713, and undivided profits for common stock are respectively $16,000,984 for the last 7 months, as compared with $14,991,979 for the 7 months ended Feb. 29, 1916.

A quarterly dividend of 1½ per cent on the preferred stock has also been declared by the General Motors Corp. of Delaware. The dividend is payable May 1 to stock of record April 12. The preferred dividend of the New Jersey company is 3½ per cent, payable May 1 to stock of record April 12.

The amount of preferred stock now outstanding is $19,980,300 and common stock $82,559,000. In other words, practically all of the authorized amounts of these two issues are outstanding, having been issued in exchange for the stock of the General Motors Co. of New Jersey, the terms of which already have been announced.

During the first 4 months of the current fiscal year the company earned about 10½ per cent on the new common, or at the annual rate of over 30 per cent.

Predictions are made that General Motors will show net profits for the full year to end July 31, 1917, of $35,000,000 to $40,000,000, or about 40 per cent on the common.

Standard Newcastle Plant Uninjured

NEWCASTLE, IND., March 12—The tornado which swept this city last night did not touch the plant of the Standard Motor Parts Co., and shipments have not been delayed.

150,249 Cars Now in Britain

Compares with 281,175 in 1914 and 137,066 in 1915—Trucks Lower

LONDON, ENGLAND, March 2—The total number of motor vehicles, including automobiles, trucks and motorcycles in Great Britain, has fallen over 200,000 since the beginning of the war in 1914. Automobiles have decreased nearly 50 per cent. The total number of motor vehicles in 1914 was 536,747, divided into 281,175 cars, 233,381 motorcycles, and 22,191 trucks. In 1915 this total fell 236,000, the number of motor vehicles at that time being 300,626, composed of 137,066 cars, 147,904 motorcycles and 15,656 trucks. The 1916 total picked up about 31,000. According to the latest census the total is 331,897, including 150,249 cars, 160,290 motorcycles and 21,358 trucks.

It is probable that the marked decrease in the total number of registered motor vehicles was due to the wholesale commandeering for Government purposes which went on in the latter part of 1914, to the action of many owners who laid up their cars for the duration of the war, and to the voluntary offering of vehicles by their owners for national service, whether in England or abroad.

Although the year 1916 saw an increase, there was on the whole a falling off. The increase was due to the increased number in the munition areas and the manufacturing towns. Herewith appears a summary of the figures for the year mentioned.

—

J. & D. Tire Re-elects Officers

CHARLOTTE, N. C., March 12—The J. & D. Tire and Rubber Co. at its annual meeting March 1 re-elected the following officers: president, H. O. Smith; vice-president, T. J. Northway; treasurer, C. C. Coddington; and secretary, L. A. Folger. These together with H. S. Leyman, W. G. Leyman, W. G. Welbon, J. L. Dabbs, and E. T. Thomason, constitute the board of directors.

—

Parker Rust Proof Changes

DETROIT, March 12—G. E. Lane, who was formerly with the Neumann, Lane Co., automobile distributor, has joined the forces of the Parker Rust Proof Co. as a member of the administrative board.

G. D. Edwards, Jr., formerly with the Springfield Body Corp., has been appointed purchasing agent for the Parker company.

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Case Now with United Motors

GRAND RAPIDS, MICH., March 8—J. M. Case has resigned as advertising manager of the Scripps-Booth Corp. to become advertising and sales manager for the United Motors Co.

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Foran Heads Scripps-Booth Advertising

DETROIT, March 12—S. W. Foran has been made the advertising manager of the Scripps-Booth Corp.

—

Higrade Will Reorganize

GRAND RAPIDS, MICH., March 12—The Higrade Motors Co. will soon be reorganized with a capital stock of $250,000, all common stock with Elmer Pratt as president. Mr. Pratt was formerly sales manager for the Pierce-Arrow Co.

—

France Needs 17,000 Farm Tractors

PARIS, March 1—It has been estimated that 17,000 farm tractors could be used for plowing purposes in France. This is on the assumption that only one-tenth of the total acreage, or 4,374,000 acres, admits of the employment of machinery for plowing. About 85,000 people are estimated as likely to be interested in the use of machinery for farming purposes.

MOTOR TRUCKS AND MOTOR CYCLES REGISTERED IN GREAT BRITAIN

	Automobiles	Motorcycles	Commercial Vehicles	Total
1914.				
England and Wales	246,862	204,365	20,358	471,585
Scotland	21,769	17,780	1,412	40,961
Ireland	12,544	11,236	421	24,201
Grand total	281,175	233,381	22,191	536,747
1915.				
England and Wales (counties)	72,861	74,315	6,710	153,886
England and Wales (county boroughs)	38,453	50,146	5,933	94,532
Total England and Wales	111,314	124,461	12,643	248,418
Scotland	16,398	14,810	2,535	33,743
Ireland	9,354	8,633	478	18,465
Grand total	137,066	147,904	15,656	300,626
1916.				
England and Wales (counties)	73,668	74,120	9,247	157,035
England and Wales (county boroughs)	44,009	57,685	7,954	109,648
Total England and Wales	117,677	131,805	17,201	266,683
Scotland	22,421	19,147	3,530	45,098
Ireland	10,151	9,338	627	20,116
Grand total	150,249	160,290	21,358	331,897

Opposing Metric System

American Institute of Weights and Measures Organized to Fight Change

NEW YORK, March 6—Realizing that there has lately been much renewed agitation in favor of the metric system, some of its opponents have formed the American Institute of Weights and Measures with the following objects in view:

"The maintenance and improvement of our present (English) system of weights and measures, for the good of our commerce and industry and the well-being of our country.

"The education of the people with respect to the importance of our weights and measures, through the dissemination of correct information with respect to them and to the danger in changes of our basic standards of measurement.

"The improvement of old and the development of additional standards as they may be needed by reason of new conditions in commerce, industry, science and engineering.

"The promotion of wise legislation for the conservation of our basic English units of weight and measure and opposition to hasty and ill-considered legislation involving changes from our fundamental English standards."

There are three grades of membership, association, corporation and individual. The annual dues of association members are $100 for associations which are national in scope and $25 for all others. The annual dues of corporation members employing less than 500 employees are $25 and of those employing more than 500 and less than 1000 employees $50, then increase at the rate of $25 for each additional 1000 employees or fraction thereof up to a maximum of $500. The annual dues of individual members are $5.

Automobile Men Interested

The members of the Council are: John F. Farrel, superintendent weights and measures of the State of New York; Fred A. Geier, president Cincinnati Milling Machine Co.; E. M. Herr, president Westinghouse Electric & Mfg. Co.; Alexander C. Humphreys, president Stevens Institute of Technology, past president American Society of Mechanical Engineers; W. R. Ingalls, editor *Engineering and Mining Journal*, president Mining and Metallurgical Society of America; D. H. Kelly, secretary Toledo Scale Co.; Henry M. Leland, president Cadillac Motor Car Co., past president Society of Automobile Engineers; William Lodge, president Lodge & Shipley Machine Tool Co.; Walter M. McFarland, Babcock &

Wilcox Co.; Henry D. Sharpe, treasurer Brown & Sharpe Mfg. Co.; Stevenson Taylor, president American Bureau of Shipping, president Institute of Naval Architects and Marine Engineers; Charles N. Thorn, president Inter-Continental Machinery Corp.; Henry R. Towne, chairman of the board of the Yale & Towne Mfg. Co., past president American Society of Mechanical Engineers; W. H. Van Dervoort, president Root & Van Dervoort Engineering Co., president National Metal Trades Assn.; Worcester R. Warner, vice-president Warner & Swasey Co., past president American Society of Mechanical Engineers.

The following officers have been elected: President, W. R. Ingalls; vice-presidents, Henry D. Sharpe and D. H. Kelly; treasurer, Walter M. McFarland; commissioner and secretary, F. A. Halsey. The Institute will open offices in New York at once.

—

Metric System in Goodyear Plant

AKRON, March 12—The metric system of weights and measures will be introduced in the plant of the Goodyear Tire & Rubber Co. This means that in all weighing systems, in all its mold designs and in all of its machinery designed in the plant the company will use the metric system.

The completion of this move will extend over a period of months. Draftsmen are already provided with metric scales and drawings are being arranged along this line.

—

Burgess Battery Co. Formed

MADISON, WIS., March 10—The Burgess Battery Co. has been organized here with a capital stock of $200,000 by the members of the C. F. Burgess Laboratories, Inc., Madison, one of the largest chemical engineering concerns in the Middle West. The new company will manufacture electrochemical products, dry batteries, flash lights and accessories.

—

Templeton Heads Detroit Commerce Board

DETROIT, March 8—A. A. Templeton, president of the Detroit Seamless Steel Tube Co. has been elected president of the Detroit Board of Commerce, succeeding Edwin Denby, treasurer of the Denby Motor Truck Co., who has retired.

—

Spence Leaves Standard Tractor

DETROIT, March 12—G. B. Spence has severed his connection with the Standard Detroit Tractor Co. to become sales manager of the Uni-Tractor Co., Chicago, maker of tractor attachments for Fords.

124,779 Carloads in 6 Months

N. A. C. C. Against National Show in San Francisco—Offer Plant to U. S.

NEW YORK, March 10—Despite the fact that transportation conditions during the past few months have been the worst ever known, the shipments of automobiles for the 6 months ending March 1 amounted to 124,779 compared with 116,469 in the same period of the previous year.

At a meeting with a record attendance of the automobile makers in the National Automobile Chamber of Commerce on Thursday, the fullest cooperation was offered to President Wilson in connection with the present international crisis. The makers pledged themselves subject to the call of the authorities at Washington for any emergency, offering their plants, their equipment and resources generally for the purpose.

The Chamber also decided against holding a National automobile show on the Pacific Coast, feeling that the best interests of the industry do not warrant an extension of the national shows beyond those of New York and Chicago. For some time the Pacific Coast dealers have been agitating in favor of a national show to be held either in San Francisco or Los Angeles.

In the absence of President Clifton, the chair was occupied by H. H. Rice, vice-president, while in attendance were more than eighty-five representatives of the automobile factories.

Closer Relations with Coast

It is expected that as a result of the month's visit of Alfred Reeves, general manager of the National Automobile Chamber of Commerce, Inc., to the Pacific Coast, where he was in constant touch with the Pacific Coast dealers, the automobile manufacturers will from this date forward be in closer touch with the Pacific Coast dealers than ever before. Mr. Reeves presented a comprehensive report to the N. A. C. C. on his visit, and while the report is not made public, it is known that the question of relationship between manufacturers and Pacific Coast dealers was handled without gloves. Apparently Mr. Reeves received many complaints from sub-dealers on the Pacific Coast who, according to their ideas, have not been well protected in certain matters. Perhaps the most important thing obtained by Mr. Reeves was that of getting the impression of the Western dealers and also giving them the thoughts of the Eastern dealers. It is known that the N. A. C. C. has during the past year done considerable work among dealers by way of getting service organizations in several cities, and also with regard to the question of handling spare parts and co-operative insurance.

Mr. Reeves thinks that the second-hand car situation is one of the biggest subjects that dealers have to handle at the present time. Mr. Reeves believes that the used car problem is little worse on the Pacific Coast than any other place. In Eastern sections of the country dealers have used market reports for valuing used cars more than on the Pacific Coast, but the Coast dealers are planning to put into use schemes for a more active valuation of used cars. It is possible that San Francisco will start in the near future some form of co-operative used car motor mart.

Automobile Shortage on Coast

At present the Pacific Coast territory is suffering severely from an automobile shortage. This is largely due to a shortage of railroad cars. General industrial conditions are normally prosperous on the Pacific Coast, but not abnormally prosperous as are conditions east of the Mississippi River. The fishing industry on the Pacific Coast is especially prosperous and every day a special trainload of fish leaves the Coast for Chicago and New York. Last year the orange crop of California was one of the best. The lemon crop in the same State was larger than previous crops. The nut industry is growing rapidly in that State.

The motor truck and farm tractor industries are developing rapidly on the Coast. Trucks are being very generally used in the orange industry. Another general use of trucks is for stage work, there being so many sections west of the Rockies where there are good centers of population not adequately served by railroads. In such places railroads would be warranted in running one train a day, but with motor buses three trips per day are made. An example of this stage work is the line from Los Angeles to Bakersfield, 150 miles. These is a three-bus service per day on this trip.

California Producing Tractors

In the farm tractor field, California has been manufacturing all of the tractors used in the State. Generally these are of the caterpillar type. Tractor conditions in California are more severe than in other parts of the country, such as the Mississippi Valley, and for this reason the development of a special type for California has been carried out in the last couple of years. Large tractor manufacturers in the Middle West admit that their sales are small west of the Rockies. Agriculture and horticulture in California demand tractors to cover a variety of uses. Frequently they operate on light, sandy soil. This has demanded a light weight machine. The caterpillar

design has proved most successful.

The fuel situation is not as serious on the Pacific Coast as in other sections, largely because there is much gasoline coming in from Mexico. Another situation which helps the gasoline problem is the very general use of distillates by many trucks. Gasoline sells at 21 cents a gallon and distillates at 11. The Moreland was one of the leaders in the use of distillate.

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Studebaker Service Gift Plan

DETROIT, March 13—According to plans of the Studebaker Corp., all of its employees with salaries under $2,000 and who do not receive pensions, will annually receive an anniversary check amounting to from 2 to 10 per cent of their earnings for the year ended. This applies to employees who have been with the company for 2 or more continuous years. Absence of 30 days or less, due to sickness, vacations, shut-downs or inventories will not be regarded as interruptions of continuous service. Two per cent will be paid for 2 years' service and 1 per cent increase for each additional year up to 10 per cent.

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Harding Returns to Advertising Agents

CHICAGO, March 12—Jack Harding has severed his connection with the Prest-O-Lite Co., Indianapolis, and returns to the Russel M. Seeds Co., advertising agent, as one of its two vice-presidents. Mr. Harding was for many years an officer of the Russel M. Seeds Co., but left that organization a few years ago, to take the position of promoter of sales of the Prest-O-Lite Co.

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Durham Joins Harroun Co.

DETROIT, March 12—B. F. Durham, who recently left the Maxwell Motor Co., Inc., to join the Stephens branch of the Moline Plow Co., has accepted a position on the sales force of the Harroun Motors Corp. Mr. Durham was connected with Ray Harroun in past years when the latter was with the Maxwell company.

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Montgomery with Harroun Corp.

DETROIT, March 10—H. Montgomery, who has been connected with the purchasing department of the Hupp Motor Car Corp., has resigned to join the purchasing department of the Harroun Motor Car Corp.

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Crawford Will Promote Regal Sales

DETROIT, March 12—E. G. Crawford, formerly Ohio district manager for the Regal Motor Car Co., has been appointed sales promotion manager to succeed R. W. Donahue, who has resigned.

Anti-Imitation Bill Is Up

Rep. Morrison Seeks To Protect Automobile and Accessory Makers by Design Registry

WASHINGTON, March 13—Seeking to protect the automobile and accessory makers, United States Representative M. A. Morrison from Indiana, has drafted and re-introduced in Congress an anti-imitation measure, designed to obviate the long, tendious, and expensive process now necessary in order to secure protection for a patent design. The bill in particular hits at pirate parts makers, whose substitutions are held to injure the recognized makers, dealers and users. The evil referred to is the manufacture and distribution of imitation parts for repair and replacement on standard accessories.

Because it costs the reputable maker more money to produce parts for replacement than it does the maker of imitation parts, the need of such legislation has been evident for a long time.

The measure introduced by Representative Morrison covers thoroughly every phase of substitution and imitation. It proposes to establish in conjunction with the patent office a bureau for the registration of designs. At this bureau a manufacturer may register the design of the completed article it makes, including the design of the various parts of which it is composed. A certificate of registration of design will be issued to the original maker, which will protect him in the design of every part of his product.

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Bradner Will Direct Auto Body

DETROIT, March 12—H. E. Bradner, manager of the Auto Body Co., Monroe, Mich., for the past 16 years, has been elected president of that company following the death of Lawrence Price, the former president.

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Will Continue Jeffery Six

KENOSHA, WIS., March 12—The Jeffery Six, made by the Nash Motors Co., will be continued throughout the season with certain changes and refinements. The production of this model will be increased.

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Dort Plant in Los Angeles?

LOS ANGELES, March 12—The Dort Motor Car Co. is considering the probability of establishing an assembly plant in this city.

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Smith Truck Shipments Increased 65%

NEW YORK, March 9—The Smith Motor Truck Corp. shipped 2075 trucks in February, an increase of 65 per cent over January. Shipments for March are expected to reach 5000, which will make total shipments for the first 90 days of 8000 trucks, against a previously estimated output for the first 4 months of 10,000 trucks. From present indications it is believed that the total sales for 1917 will reach 45,000. On the basis of 30,000 trucks for the year the company expects to earn $3,000,000, which, after deducting the preferred dividend of $112,000, would give a surplus of over $2,800,000, equivalent to more than 25 per cent on the common.

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Hoosier Sub-Carburetor to Move

DUNKIRK, IND., March 8—The Hoosier Sub-Carburetor Co. has reorganized and will move to Indianapolis this month. The company has increased its capital from $10,000 to $25,000. The directors are: E. W. Steinhart, Indianapolis, president; George Black, Dunkirk, vice-president; C. W. Smalley, Dunkirk, treasurer; F. H. Hoover, Indianapolis, secretary, and J. W. Fudge, general manager. The company is reducing the price of its carburetor for Fords from $10 to $7.85.

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Truck Converter Co. in California

LOS ANGELES, CAL., March 8—To manufacture a universal attachment for converting passenger car chassis into commercial vehicles, the Le Munyon & Bidelman Co. has been organized and construction begun at Alhambra, a suburb of Los Angeles. In addition to the truck attachment, this company expects to build a gasoline propelled transportation tractor of unique design. It will also produce a magneto charging instrument.

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Chandler Shipments Gain 50 Per Cent

CLEVELAND, March 9 — The Chandler Motor Car Co. shipments in January and February were 50 per cent ahead of the corresponding months of last year, notwithstanding the shortage of railroad freight cars. In the full year 1916 the company shipped over 13,000 cars and earned $24 per share.

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Standard Parts Large Feb. Business

CLEVELAND, March 10 — The rim and tube division of the Standard Parts Corp. experienced its largest February business during the past month, when it shipped 183,839 pieces of exhaust pipes and other tubular parts in the 28 days.

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Rainier Making Deliveries

NEW YORK, March 12—The Rainier Motor Corp., Flushing, N. Y., is now making deliveries of its delivery car. The factory was started less than 6 months ago. Deliveries are now averaging five machines daily.

Headlamps Talk for N. Y. S. A. E.

Metropolitan Section To Hear Complete Review of Lighting Situation by McMurtry

NEW YORK, March 14—Alden McMurtry, who has been experimenting with automobile lighting for years, will read a paper covering the whole subject to the Metropolitan section of the S. A. E. at the Automobile Club of America to-morrow evening. There have been many papers on this subject, but most of them have taken up one particular branch of it. McMurtry's paper covers the whole field. The object in writing it has been to provide a document that explains the whole subject in a way that allows anyone to understand what the problems are and why the perfect solution is so hard to find. It will be elaborately illustrated, but it does not go into optical detail in a way that only a student of the science of light can understand.

McMurtry brings out very strongly the undoubted fact that we shall never be within sight of the end of glare agitation until manufacturers equip their cars with better lamps. A good lamp cannot possibly be made for $1.50, which is about as much as the average maker of low price cars puts on his machines. The paper shows that many of the focusing devices are really quite worthless, because they cannot be operated with any degree of accuracy and sometimes have not so much range of adjustment as the bulbs have of variation.

In the conclusions the author expresses the belief that the 42-in. rule is the best basis for legislation so far discovered, supporting the findings of the S. A. E. committee.

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Detroit S. A. E. Employment Exchange

DETROIT, March 13—The Detroit section of the S. A. E. has arranged plans for an employment exchange for the members of the section. The exchange will be conducted in the office of the section, 706 Kresge Building, Detroit.

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Fire at Cole Plant

INDIANAPOLIS, IND., March 12—Fire in a temporary finishing room at the plant of the Cole Motor Car Co. caused a loss of $15,000 last Thursday night. Officials of the company announced that although a few car bodies had been damaged that the blaze would not affect the production of the plant in the least.

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Oneida Truck Leases Plant

GREEN BAY, WIS., March 10 — The Oneida Motor Truck Co., Green Bay, Wis., organized with $300,000 capital to build the Oneida motor truck, expects to start manufacturing operations by April 1. The company has taken a lease on the large factory building at Webster Avenue and Willow Street, Green Bay, where space 140 by 50 and 100 by 60 ft. is available.

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Dey Electric Plant for York

NEW YORK, March 9—J. W. Guthrie has joined H. W. Hayden, and these two men are now busy organizing a factory at York, Pa., to manufacture the Dey electric. It will be remembered that this is the inexpensive electric with the patented axle and motor system invented by Dr. Steinmetz. It is planned to commence deliveries about June next.

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St. Louis Chevrolet to Supply 1000 Cars to N. Y. Office

ST. LOUIS, MO., March 13—The Chevrolet factory here is being speeded up 50 per cent this month in an effort to supply 1000 cars to the New York office without lowering the planned output here, according to Russell E. Gardner, Jr., manager of the St. Louis plant. Mr. Gardner says that it was the plan to turn out 2000 cars here for local trade, and when a request came from New York for 1000 cars to aid that distribution point in reaching 27,000 cars for the month, he added that number.

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Goodyear Purchases Fabric Mills

AKRON, March 12—The proceeds of the recent stock issue of the Goodyear Tire & Rubber Co. will be used in part for the financing of a deal whereby the Goodyear company buys fabric mills in Connecticut. The fabric end of the business will be handled by a new corporation recently formed under the name of the Goodyear Tire & Fabric Co.

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Made 65,400 Fords in January

DETROIT, March 9 — The Ford Motor Co. manufactured 65,400 Ford cars during the month of January, which is an average of 2616 cars per working day. In its report the company states that it now employs 37,000 men and is increasing its capacity to 3000 cars per day.

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Reo Acquires Gier Steel Plant

LANSING, MICH., March 8—The Reo Motor Car Co. has purchased the old steel plant belonging to the Gier Pressed Steel Co. and will use it temporarily for storage purposes. The plant has 44,000 sq. ft. of floorspace.

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Moreland Plans New Factory

LOS ANGELES, CAL., March 9 — The Moreland Motor Truck Co., truck manufacturer, is planning the erection of a new plant at Alhambra, to cost about $200,000.

New License Law in Missouri

Fees Range $4 for 12 Hp. to $24 for 72 Hp.—Muffler Cut-outs Prohibited

ST. LOUIS, MO., March 12—The new motor vehicle license law has been passed by the Missouri Assembly and will become effective July 1. It was designed as a revenue measure, being calculated to raise $1,000,000 additional. Fees for licenses are: 12 hp., $4; 12-24 hp., $6; 24-36 hp., $10; 36-48 hp., $14; 48-60 hp., $16; 60-72 hp., $20; 72-up hp., $24.

The law restricts cities to a charge of one-half of the state license for cars, and branch offices for collections will be opened in Kansas City and St. Louis. It is a misdemeanor for an intoxicated person to drive a car and after three convictions the driver's license shall be revoked and not issued until the trial judge and prosecuting attorney indorse the application. Muffler cut-outs are prohibited. Tampering with or using a machine without consent of the owner is made a misdemeanor, the punishment running up to 5 years in prison.

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Peerless Protests Chapman Verdict

CLEVELAND, March 9 — The Peerless Motor Car Co. has filed a protest in the common pleas court against the verdict granted H. S. Chapman for $412,812 and which was regarded as a commission on war orders by another court.

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Receiver for Reliance Engineering Co.

LANSING, MICH., March 10 — F. D. Eaman of Detroit has been appointed receiver for the Reliance Engineering Co. of this city. The concern has been doing a large business in the manufacture of automobile parts. The specific cause for the petition was the company's failure to pay interest on bonds, of which $550,000 are outstanding.

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Injunction Against Truck Fender Ordinance

CHICAGO, March 14—Motor truck owners won the last skirmish in their fight against Chicago's truck fender ordinance to-day when Judge F. A. Smith of the Circuit Court granted a temporary injunction against the enforcement of the city's truck fender ordinance. The Motor Truck Owners' Assn., which has been fighting the ordinance as illegal, unfair and impossible to comply with, also as dangerous to pedestrians, yesterday filed a bill for an injunction. Judge Smith set March 27 for the final hearing.

$500,000 Swinehart Stock Issue

Growth of Tire Business Requires New Capital—Portage Plans Stock Issue

AKRON, OHIO, March 10—Swinehart Tire & Rubber Co.'s stockholders are being offered $500,000 7 per cent cumulative and convertible preferred stock at par. The company has $800,000 one class stock outstanding. The new stock is offered to present holders on the basis of five-eighths of a share of new for one held.

President Thomas F. Walsh stated that the business has grown so that its facilities are inadequate to the volume and that it has been compelled to refuse some orders. He said that plant addition would be built and a new equipment would be installed. Mr. Walsh said that high costs and difficulties of shipping result in unusually large amounts of money being tied up in the course of the business. The new stock will be convertible into common at any time within 5 years, share for share at par. The common now pays 6 per cent dividends.

This is the fourth Akron company to announce a financing plan within a fortnight, involving sale in all of $15,370,000 new stock.

It is understood also that the Portage Rubber Company of Barberton is to have a plan under consideration the details of which will be announced in the near future. Portage stock continues very strong. It sold in Cleveland yesterday at 180 and 182 and in this city as high as 184. One share of Goodyear sold at 240, the preferred bringing 108.

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Pierce-Arrow Common All Sold

NEW YORK, March 10—Eugene Meyer, Jr., & Co. have bought from the syndicate manager the unsold balance of the Pierce-Arrow Co. common stock which they are offering at $46 per share, less a commission to bankers and brokers.

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$7 Per Share for S. R. B. Stock

PHILADELPHIA, March 8—The Girard Trust Co. is paying shareholders of the Standard Roller Bearing Co. $7 per share for the common, first and second preferred stock upon surrender of certificates of deposit. The holders of receipts of deposit for unsecured claims, merchandise accounts and for bills payable against the company deposited with the creditors' committee are being paid by the Guaranty Trust Co. in New York.

BALANCE SHEET OF LEE RUBBER & TIRE CORP. AS OF DEC. 31, 1916

Assets		
Cash	$258,560	
Accounts receivable	349,777	
Notes receivable	8,415	
Lee Tire Sales Company current accounts	112,313	
Inventories	1,601,443	
		$2,330,508
Charges deferred		28,540
Investment		500
Plant and equipment		1,206,229
Patents, trade-marks, etc.		400,300
Total		$3,966,078
Liabilities		
Accounts payable and accruals	$75,814	
Notes payable	1,000,000	
		$1,075,814
Reserves:		
Depreciation of plant and equipment	$191,661	
Adjustment of tire claims	38,633	
Income tax	9,982	
		240,277
Declared capital, 100,000 shares	750,000	
Working capital, being cash and actual book value of securities owned in excess of required declared capital	1,883,591	
		2,633,591
Surplus		16,395
Total		$3,966,078

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum, lb.	.58	.58	.58	.58	.58	.58	...
Antimony, lb.	.32	.32	.32	.31	.31	.31	— .01
Bessemer Steel, ton	70.00	70.00	70.00	70.00	70.00	70.00	...
Copper, Elec., lb.	.37	.37	.37	.37	.37	.37	...
Copper, Lake, lb.	.37	.37	.37	.37	.37	.37	...
Cottonseed Oil, bbl.	13.53	13.28	13.41	13.33	13.41	13.40	— .13
Fish Oil, Menhaden, Brown, gal.	.74	.74	.74	.74	.74	.74	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal.	1.50	1.50	1.50	1.50	1.55	1.55	+ .05
Lead, 100 lb.	10.75	10.75	10.50	10.25	10.25	10.25	— .50
Linseed Oil, gal.	.96	.97	.98	.98	.98	.98	+ .02
Open-Hearth Steel, ton	70.00	70.00	70.00	70.00	70.00	70.00	...
Petroleum, bbl., Kans., crude	1.70	1.70	1.70	1.70	1.70	1.70	...
Petroleum, bbl., Pa., crude	3.05	3.05	3.05	3.05	3.05	3.05	...
Rapeseed Oil, refined, gal.	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River Para, lb.	.79	.78	.78	.77	.77	.77	— .02
Rubber, Ceylon, First Latex, lb.	.81	.84	.83	.83	.83	.83	+ .02
Sulphuric Acid, 60 Baume	1.00	1.00	1.00	1.00	1.00	1.00	...
Tin, 100 lb.	54.50	54.50	54.50	53.63	53.63	53.50	—1.00
Tire Scrap, lb.	.06½	.06½	.06½	.06½	.06½	.06½	...

$3,346,761 Lee Tire Sales

Labor Troubles Affect Profits —$12,337 Surplus — Large Materials Supply on Hand

NEW YORK, March 8—Net sales of $3,346,761 are reported by the Lee Rubber & Tire Corp. in its annual statement covering the period ended Dec. 31 last. The cost of goods and all expenses were $3,340,860, leaving an operating profit of $246,901. The income from rentals, etc., totaled $4,162, making the total income $251,063. Out of this amount $13,726 was paid out for interest, discounts, etc., leaving $237,337 for dividends. The stockholders received $225,000, leaving a surplus of $12,337.

During the year the company has built an additional mill in which to conduct the manufacture of its miscellaneous rubber and surgeons' goods. The earnings for the first half of the year were satisfactory, but labor troubles, together with the great increase in the cost of crude rubber and fabric, caused a falling off in profits during the last 6 months.

The company has made some changes in the process of its manufacturing and is now producing not only the wrapped tread type of tire but molded tires.

The consolidated balance sheet shows a large inventory. This is on account of stocks of crude rubber and fabrics which the company has considered wise to carry on hand. The balance sheet as of Dec. 31 last appears herewith.

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Material Prices Steady

NEW YORK, March 14—Prices of automobile materials were fairly steady last week. The usual changes occurred. Ceylon rubber rose 2 cents a lb. to 83 while Para rubber dropped 2 cents a lb. to 77. Lard oil reached $1.55 per gal., and lead and tin dropped 50 cents and $1.00 respectively per 100 lb.

At the present time metal conditions are very complex and are making forecasting difficult. Rubber prices are also unsettled. As estimated, the United States is using about 61 per cent of the world's rubber supply, Great Britain 10 per cent and France 8 per cent. Exports of crude rubber from the producing areas in 1916 were approximately 443,000,000 lb., of which the United States took 270,000,000 lb.

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Rise in Egyptian Cotton Prices May Cause Tire Increase

NEW YORK, March 10—Tire prices are expected to rise as a result of the increase in prices of Egyptian cotton from Alexandria. The declaration of an embargo on shipments of that grade of cot-

ton from Alexandria and Liverpool this past week was followed by a sharp rise in spot Egyptian cotton in this country. Sakellaridis cotton of the grades used extensively in this country for automobile tire yarns and other purposes jumped between 3 and 4 cents a pound, commanding 56 to 57 cents, as compared with 52 to 53 a week or 10 days ago.

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Ellermann Joins Ohio Electric

DETROIT, March 14—A. H. Ellermann, formerly in the production department of the Wagner Electric Mfg. Co., St. Louis, is now in the engineering department of the Ohio Electric Vehicle Co. Melvin Wadsworth has been made factory representative for New York and New England for the Ohio electric.

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Dividends Declared

Willys-Overland Co., quarterly of 1¾ per cent on preferred, payable April 1 to stock of record March 20.

Electric Storage Battery Co., 1 per cent from net earnings of company on both common and preferred, payable April 2 to stock of record on March 19.

Kelly-Springfield Tire Co., quarterly of $1.50 on 6 per cent preferred stock, payable April 2 to stock of record March 17.

Rubber Goods Mfg. Co., quarterly of 1¾ per cent on preferred, payable March 15 to stock of record March 10.

Manhattan Electrical Supply Co., quarterly of 1 per cent on common, payable April to stock of record March 20.

Edmunds & Jones, quarterly of $1.75 on preferred, and $1 on common, payable April 1 to stock of record March 20.

Automobile Issues Higher

Dividend and Financial Statements During Past Week Responsible for Rise

NEW YORK, March 14—Dividends and talk of dividends together with favorable financial statements in the automobile industry tended to mark up prices of securities last week. Gains ranged from a fraction to 12¼, featured by Portage Rubber which is stated will soon increase its capital. Several of the tire issues were strong last week. Kelly-Springfield, especially, was strong, its common rising 5 and the preferred 1 point. This company earned $8.70 a share of common stock after allowing for preferred dividends. This compares with $7.42 earned in 1915. The plant, it is stated, will be brought up to a daily capacity of 1000 tires.

General Motors stock advanced to a maximum gain of about 7 points and a net gain of 5½ points on the announcement of an increase in the dividend to a 12 per cent basis, which accompanied a favorable report on gross sales.

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Yale & Towne Earn $3,386,420

NEW YORK, March 10—The Yale & Towne Mfg. Co. reports net earnings of $3,386,420 for the year ended Dec. 31 last, a gain of 61 per cent over 1915. The stockholders received $1,513,530 and depreciation amounted to $662,570, leaving a surplus of $1,210,308, swelling the total reserve to $7,259,132. This company does quite an extensive business in automobile locks for coil switches, tool and battery boxes, tire holders, luggage boxes, etc.

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Westinghouse January Profits $2,082,700

NEW YORK, March 12—The Westinghouse Electric Co. had net profits of $2,082,700 in January of this year. Total net profits for the 10 months ending Jan. 31 were $13,665,200, equal to 22.66 per cent on the $60,000,000 stock as against 17 per cent earned in the full fiscal year.

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Lapeer Tractor Truck Co. Formed

LAPEER, MICH., March 12—The Lapeer Tractor Truck Co. has been incorporated, here, for $100,000 to manufacture tractor trucks.

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$400,000 Capital Increase for Gordon

CANTON, OHIO, March 8—To take care of factory expansion, the Gordon Rubber Co. will increase its capital $1,000,000. The present capital is $600,000. The issue will consist of $500,000 preferred and $500,000 common.

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Brown Carriage to Increase Capital

CLEVELAND, March 9—The Brown Auto Carriage Co., one of the largest automobile body concerns here, is to increase its capital stock to $750,000. It is the intention of the company to build a body plant large enough to take care of the

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	67	72	—1
*J. I. Case T. M. Co. pfd	79⅜	88	—3⅝
Chalmers Motor Co. com	20	30	—5
Chalmers Motor Co. pfd	..	..	..
Chevrolet Motor Co.	117	122	+4
*Chandler Motor Car Co.	102	104	+4
Fisher Body Corp. com.	35	40	..
Fisher Body Corp. pfd.	94	96	+3
Fisk Rubber Co. com.	75	85	..
Fisk Rubber Co. 1st pfd.	101	105	..
Fisk Rubber Co. 2d pfd.	70	100	..
Firestone Tire & Rubber Co. com.	144	145	+ ½
Firestone Tire & Rubber Co. pfd.	107½	108¼	+ ½
*General Motors Co. com.	119½	120½	+5
*General Motors Co. pfd.	89⅜	90⅜	+ ⅜
*B. F. Goodrich Co. com.	55¼	55½	— ¾
*B. F. Goodrich Co. pfd.	108⅞	110	+ ⅞
Giodyear Tire & Rubber Co. com.	238	243	—2
Goodyear Tire & Rubber Co. pfd.	107¾	108½	+ ¾
Grant Motor Car Corp.	5	7	..
Hupp Motor Car Corp. com.	3½	4½	..
Hupp Motor Car Corp. pfd.	85	90	..
International Motor Co. com.	..	18	..
International Motor Co. 1st pfd.	..	70	..
International Motor Co. 2d pfd.	..	30	..
*Kelly-Springfield Tire Co. com.	60	61	+5
*Kelly-Springfield Tire Co. 1st pfd.	92	94	+1
*Lee Rubber & Tire Corp.	22	22½	+3
*Maxwell Motor Co., Inc., com.	55	55½	—1½
*Maxwell Motor Co., Inc., 1st pfd.	71	71¼	+1
*Maxwell Motor Co., Inc., 2d pfd.	35	35½	..
Miller Rubber Co. com.	259	264	—2
Miller Rubber Co. pfd.	105	106	+ ½
Packard Motor Car Co. com.	156	164	..
Packard Motor Car Co. pfd.	100	101	..
Paige-Detroit Motor Car Co.	37¾	38½	— ¼
Peerless Truck & Motor Corp.	15	19	..
Portage Rubber Co. com.	174	180	+12¼
Portage Rubber Co. pfd.	..	..	..
Regal Motor Car Co. pfd.	..	26½	+1½
Reo Motor Car Co.	36¾	37	+ ¼
*Saxon Motor Car Corp.	56	57	+1⅜
Springfield Body Corp. com.	70	80	..
Springfield Body Corp. pfd.	110	120	..
Standard Motor Construction Co.	7	8	..
*Stewart-Warner Speed. Corp.	81½	82½	—1
*Studebaker Corp. com.	102½	103	+2⅜
*Studebaker Corp. pfd.	104	105	+1
Swinehart Tire & Rubber Co.	80	84	+1
United Motors Corp.	39½	40	+ ½
*U. S. Rubber Co. com.	59¼	60	+2¾
*U. S. Rubber Co. pfd.	108¼	109	+1
*White Motor Co.	50	51	+1
*Willys-Overland Co. com.	35	35½	+ ⅜
*Willys-Overland Co. pfd.	98⅜	100	+1⅜

*At close March 12, 1917. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	..	33	..
Chalmers Motor Co. com.	..	..	..
Chalmers Motor Co. pfd.	..	..	..
Continental Motor Co. com.	8	8½	..
Continental Motor Co. pfd.	98	99	..
Ford Motor Co. of Canada	250	..	+2½
General Motors Co. com.	..	..	..
General Motors Co. pfd.	..	..	..
Maxwell Motor Co. com.	53	56	..
Maxwell Motor Co. 1st pfd.	..	..	..
Maxwell Motor Co. 2d pfd.	..	..	..
Packard Motor Car Co. com.	156	..	—2
Packard Motor Car Co. pfd.	104¼	102½	..
Paige-Detroit Motor Car Co.	37½	38	..
W. K. Prudden Co.	44	45¾	..
Reo Motor Car Co.	36½	36⅜	+ ¼
Studebaker Corp. com.	104	106	+6
Studebaker Corp. pfd.	..	..	..
C. M. Hall Lamp Co.	..	30½	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	..	..
Kelsey Wheel Co.	..	..	..
Regal Motor Car Co.	..	26½	..

business which it heretofore has been compelled to refuse, owing to limited factory facilities, and which has been going out of Cleveland.

—

Shuler Axle Increases Capital

DETROIT, March 12—The Shuler Axle Mfg. Co. has increased its capital stock from $100,000 to $150,000.

—

Speedway for San Francisco

SAN FRANCISCO, CAL., March 10 — A speedway, backed by the California Speedway Assn., will be built near San Mateo. Active work on the course will start within a short time. I. R. Gates is manager.

—

Davis Enters Intercity Run

DETROIT, March 8—Robert K. Davis has filed his entry for the intercity reliability tour, which starts from Buffalo July 17, with W. S. Gilbreath, manager of the Detroit Automobile Club.

—

Overland Earns $5.71 Per Share

(*Continued from page* 537)

net earnings, as the profit on cars delivered to distribution points under the agency system appear in the accounts at the time of the shipment, while under the new system such profits are delayed to the date of ultimate sale. If the net profits of the year had been compiled on the same basis as in 1915 they would have been $1,318,665 larger than reported. At the present time unfilled orders for immediate delivery are over 20,000 cars, the largest amount in the history of the company.

"The cost of manufacture advanced during the year, due mostly to many important causes not peculiar to our company, but almost universal among American manufacturers. The principal increases in our costs, other than these general advances, were of a temporary character, notably a decided increase in the public demand for closed cars, and our voluntary policy of writing down the value of our tool equipment.

"The rapid growth of the business necessitated capital expansion during the year. In January the preferred stock was retired and a new issue of $25,000,000 was authorized. Of this new issue $15,000,000 7 per cent cumulative stock, convertible into common stock, was sold at 102½. Late in the year the common stock was increased from $25,000,000 to $50,000,000 and $15,000,000 of the new stock was offered to stockholders at $44 per share.

"Part of the capital raised by these sales was used for expansion of plants, warehouses, office facilities and distributing branches. The larger part of it, however, remains as a free working capital, so that this company can meet with safety and comfort all the demands of increased production, high costs, and a general business situation liable to sudden and sweeping changes. The cash position of the company is strong and will remain strong.

"The earnings of the company received practically no benefit from the major part of this increase in capital, as the increase was made late in the year and the work done with the money received had hardly begun to show in production and sales at the close of the year."

Chicago Show For Used Cars

Several Hundred Automobiles Will Be Exhibited in Coliseum May 5-13

CHICAGO, March 13—An automobile show devoted exclusively to used cars is the latest of unusual solutions for handling the used car problem and is proposed by Chicago dealers. The Coliseum, which has been the scene of annual automobile shows, is to be filled May 5 to 13 by the Chicago Automobile Trade Assn. Not a single new car will be seen among the several hundred exhibits and the cars will be sold direct from the floor. It is probable that some of them will be disposed of at auction.

—

Twelfth Used Car Report

CHICAGO, March 12—The Twelfth Edition of the National Used Car Market Report has been issued by the Chicago Automobile Trade Assn. The report is intended for use from Feb. 1 to May 1 and is exactly like previous reports except that six cars not mentioned previously now are listed. These are: Anderson, Ben Hur, Luverne, Rayfield, Richmond and Stephens. Three new dealer associations have been added to the list now using the report, making the total number thirty-nine. The new associations are: Peru Automobile Dealers' Assn., Peru, Ind.; Reading Automobile Dealers' Assn., Reading, Pa.; Springfield Auto Trades Assn., Springfield, Ohio.

—

$181,900 for Twin City Receiver

ST. PAUL, MINN., March 9—Judge H. O. Hanft of the district court has ordered James F. Sperry to pay $181,900 to the receiver of the Twin City Motor Speedway Co. This is the result of the first of four suits brought by P. W. Herzog, receiver in Ramsey county.

—

Elgin Race Date Aug. 18

CHICAGO, March 12—Sanction has been granted by the American Automobile Assn. for the annual Elgin road races, the date being Aug. 18.

—

C. S. Connor in Omaha

DETROIT, March 14—C. S. Connor, assistant branch manager of Studebaker, Chicago, has been promoted to branch manager in Omaha.

Balance Sheet of Willys-Overland Co. and

Assets

Property account: Land, buildings, plant and equipment:

	Factory Property	Branch House Property	Together
Land	$859,522.60	$1,883,217.17	$2,742,739.77
*Buildings and building equipment	10,363,468.85	4,579,226.89	14,942,695.74
Machinery and equipment	9,893,005.32	114,733.81	10,007,739.13
Tools, dies, patterns and drawings (depreciated value)	1,522,093.30	11,137.25	1,533,230.55
Furniture and fixtures	282,594.63	125,549.84	408,144.47
Automobile and truck equipment in service	97,127.81	66,220.18	163,347.99
Leasehold investments	.....	229,006.65	229,006.65
Expenditures on machinery and equipment in course of construction	346,205.76	.....	346,205.76
Totals	$23,364,018.27	$7,009,091.79	$30,373,110.06
Deduct—Reserve for depreciation and accruing renewals, balance at December 31, 1915		$957,128.49	
Amount provided out of earnings for the year, exclusive of provision for depreciation of tools, dies, patterns, etc. ($1,028,132.46) deducted from the asset		951,379.67	
Together		$1,908,508.16	
Less replacement expenditures and losses on dismantled property written off		314,411.35	1,594,096.81
			$28,779,013.25
Goodwill, patents, trademarks, etc			14,059,932.21
Total property investment			$42,838,945.46
Investments in and advances to affiliated manufacturing companies, as valued on the basis of this company's interest in the book value of the net tangible assets represented			2,291,642.23
Current assets: Inventories at or below cost, at factories:			
Raw materials, supplies, unassembled parts and service stock.†	$33,002,160.97		
At branches and warehouses:			
Finished cars, new and used, including freight	$4,435,897.70		
Service stock, accessories and supplies	1,151,481.00	5,587,378.70	$38,589,539.67
Balance due from European distributing agent			624,489.53
Accounts receivable, less reserves			4,435,080.89
Notes receivable (distributors' and other notes)			1,786,290.14
Guaranty Securities Co. certificates of beneficial interest in customers' deferred instalment notes			372,148.98
Miscellaneous investments			385,639.85
Cash in banks and on hand		11,404,950.45	57,598,139.51
Deferred charges to future operations:			
Prepaid interest, insurance, etc			381,279.20
			$103,110,006.40

*Includes outlays on buildings in course of construction in respect of which it is estimated a further $625,000.00 will require to be spent to complete.

†The valuation at which the raw material and supply stocks have been inventoried, viz., at or below cost to the company, is conservatively estimated to be $6,000,000.00 below the cost of replacement at the company's current buying prices.

Export Conference June 23

Industrial Exposition at Springfield, Mass., Will Take Up Marketing Questions

SPRINGFIELD, MASS., March 12—Automobile manufacturers will be interested in the announcement of an Industrial Exposition and Export Conference which will be held here June 23 to 30. The Eastern States Exposition will conduct the affair. The conference program will include some of the leaders in the industrial life. A series of small meetings in manufacturing centers is being planned to acquaint the trades generally with the opportunity to reach a great home market as well as to cooperate for the united front in the foreign field. F. H. Page, president of the National Equipment Co. is chairman of the market committee.

—

Jeffery Distribution Centralized in Milwaukee

MILWAUKEE, March 9—Jeffery passenger and commercial vehicle distribution in Wisconsin, upper Michigan, and the upper Mississippi Valley has been centralized in this city by the establishment of the Nash Sales Co., capitalized at $500,000, which takes over the territorial rights of the Osmond-Vogel Co., and much additional territory. The backers of this new company are Rudolph Hokanson, G. P. Miller and Byron Stebbins, Madison, owners of the Hokanson Automobile Co., Buick and Oakland distributor. N. E. Osmond and H. M. Vogel will devote their attention to the distribution of the Chalmers in Wisconsin and upper Michigan.

—

Doble Steamer in Boston

BOSTON, March 13—*Special Telegram*—The General Engineering Co., Detroit, has placed the Boston agency for the Doble steamer with the Henly-Kimball Co. This company distributes the Hudson in Boston and Eastern Massachusetts and it is understood will have the same territory on the Doble.

—

Leavitt Increases Chevrolet Territory

LOS ANGELES, March 10—The J. W. Leavitt Co., recently appointed Los Angeles county Chevrolet representative, has increased its territory to include San Francisco, Oakland and San Diego.

Subsidiary Companies as of Dec. 31, 1916

Liabilities

Capital stock—authorized:			
Seven per cent cumulative preferred stock—100,000 shares of $100.00 each		$10,000,000.00	
Seven per cent cumulative convertible preferred stock—150,000 shares of $100.00 each		15,000,000.00	
Common stock—2,000,000 shares of $25.00 each		50,000,000.00	
		$75,000,000.00	
Issued and outstanding:			
Seven per cent cumulative convertible preferred stock		$15,000,000.00	
Common stock (excluding stock dividend of 5 per cent declared payable to stockholders of record on March 15, 1917)	$39,269,400.00		
Script certificates in respect of fractional shares of stock	2,990.00		
Together	$39,272,390.00		
Less employees' stock subscriptions unpaid	1,998,545.91	37,273,844.09	$52,273,844.09
Purchase money obligations:			
Real estate mortgages assumed			165,000.00
Total capital obligations			$52,438,844.09
Current liabilities:			
Notes payable		$11,849,067.06	
Accounts payable		7,538,411.10	
Payrolls and salaries accrued		531,256.60	
Customers' deposits		808,324.63	
Taxes and interest accrued		310,784.58	
Reserve for rebates to customers		441,140.13	
Reserve for car repairs under guarantee		304,000.00	
Reserve for royalties payable		29,084.00	
Preferred stock dividend declared payable Jan. 1, 1917		262,500.00	22,074,568.10
Reserve funds:			
For future contingencies			1,000,000.00
Surplus:			
Balance at Jan. 1, 1916		$14,720,549.52	
Add net profits and income for the year ending Dec. 31, 1916, as per statement attached		9,565,718.54	
		$24,286,268.06	
Deduct—Dividends paid and declared:			
On preferred stock	$994,705.30		
On common stock:			
In cash	$2,503,249.50		
In stock (excluding stock dividend payable to stockholders of record March 15, 1917)	1,155,690.00	3,658,939.50	4,653,644.80
		$19,632,623.26	
Add premiums received on securities issued less premiums paid on securities retired, expenses of refinancing and goodwill of affiliated companies purchased during the year and written off—net		7,963,970.95	27,596,594.21
			$103,110,006.40

Boston Show Sales $3,000,000

Nearly 2000 Cars Sold—All Attendance Figures Broken —Big Trade Predicted

BOSTON, March 10—All attendance figures were broken at the local automobile show which closed to-night. Over 275,000, or 50,000 more than last year, entered the building. During the last 3 days it was necessary to close the doors at times on account of the crowds. It is estimated that close on to $3,000,000 was spent in purchases of cars, sales of which reached nearly 2000. More than 4500 dealers from all over New England registered during the week, doubling last year's mark.

As a direct result of the show it is freely predicted by dealers that by June 1 it will be almost impossible to get a 1917 car from any dealer. Allotments now have been made up for the year and with practically every dealer running away ahead of scheduled deliveries an early shortage seems likely.

The show was almost entirely a retail show, few wholesale contracts being signed. For the most part out-of-town dealers who attended already had signed contracts and came to the show to meet their prospects and sell them if they could, and also to badger the distributor for more cars.

The salon, held at the Copley-Plaza, was not as well attended as the dealers had hoped would be the case. The impression prevailed that the admission charge of $1 was too high, and that tickets to Mechanics Hall should have had a stub, which, with an additional 25 cents, would admit to the salon. As it was, few persons visited the salon.

Motor truck dealers are particularly optimistic following the closing of the show. Many of them made sales off the floor and almost without exception long lists of prospects have been obtained.

Motor truck sales were large and a long list of prospects was chalked up. Truck sales, it is stated, will be stimulated by the present freight congestion along the Atlantic seaboard.

Of late there has been some slight sentiment in favor of a separate truck show. The sentiment of the dealers is toward having the passenger car and motor truck shows combined, the truck show being held a week earlier than the car exhibition.

—

Packard Sold $4,000,000 Trucks

DETROIT, March 9—The Packard Motor Car Co. sold more than $4,000,000 worth of motor trucks in January and February, all for domestic use.

The Automobile

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Drifting from Job to Job

WE hear much about labor turnover. Employers, everywhere, are discussing the large numbers of workers who quit their jobs every month.

Consider the four means by which men may earn a livelihood. They can work for a wage, sell something for a profit, loan money at interest, or lease property at a rental.

Most men work for a wage. The next largest group sells something at a profit. It is these two classes that are involved in labor turnover—the employer and the employee.

Both are interested in a common factor—a steady production that insures steady profits and steady wages. Each is anxious for the stability that means a continuance of income.

Yet more than 35 per cent of the workers in this country drift from job to job. Apparently there is something wrong.

This situation can be remedied. On one hand are employers anxious for many employees. On the other are workers who desire steady work but refuse, in many cases, to work steadily at various positions.

Why should labor find some positions more agreeable than others? What have the agreeable positions that the others lack? Let us observe those few employers who do not suffer from labor turnover and examine their institutions.

Each, investigation reveals, has performed many acts in common with the others. And a brief summary of their deeds shows that they have installed systems, devices and plans that:

Provide light factories.
Make sanitary work rooms.
Aid workers to secure homes.
Provide healthy recreation.
Extend opportunities for higher education.
Insure faithful service against want in old age.
Guarantee workers against privation if injured by accident.
Provide facilities for improving health.
Instill a proprietary feeling.
Create loyalty.

It is quite likely that labor turnover is merely the expression of labor against disagreeable working conditions, that employers suffer from it because of these conditions and that the solution lies in their immediate removal.

Proper Side Curtains

THE increased use of cars for winter driving as well as for summer, makes it a matter of necessity for putting on side curtains which will be safe as well as convenient. Side curtains which do not afford proper vision for the driver are a source of danger and should not be put on the car as stock equipment by any manufacturer. A large number of accidents occurred this winter simply because the driver could not see conveniently to both sides of him with the side curtains in place. This constitutes a danger which has resulted in serious accidents.

The recent adaptations of the side curtain equipment which opens with the doors are improvements which are appreciated widely by car owners. They are appreciated for two reasons. First, because they eliminate the necessity for stooping when entering the car and for breaking millinery, and second, they contain as a rule an ample amount of space for clear vision. This part of side curtain equipment is something which should not be overlooked by the automobile and body manufacturer.

Uninterrupted Through Traffic

IT is general practice in the large municipalities to give the right of way to those traveling on through street. The necessity of slow-down at every cross street and the acceleration for a dash to the end of the next block is one of the nerve-racking parts of city driving. Furthermore, it is one of the most potent causes for the rapid wear of clutches and brakes. The penalties for those who do not slow down in crossing main thoroughfares should be made more severe than for almost any other traffic offense, because the man who does this is the man who is responsible for the most serious accidents. The worst collisions are those which have occurred because a driver neglected to slow down when crossing a through thoroughfare.

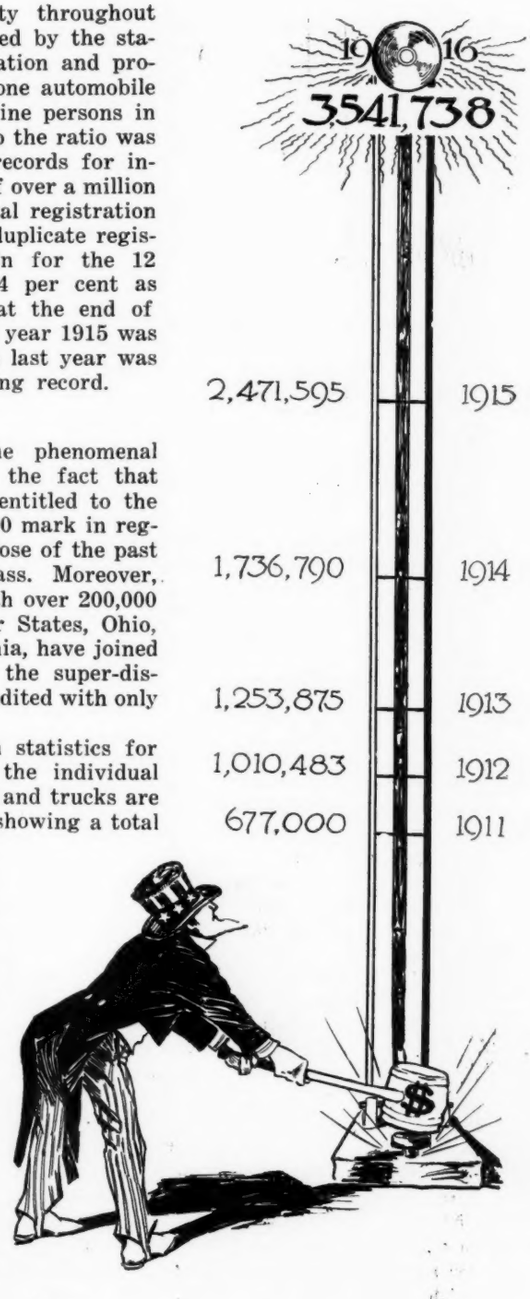
In order to promote general traffic efficiency, these through thoroughfares should be well defined, marked and have a much higher speed limit at the crossings than is permissible on cross-town streets.

A Car for Every 29 Persons *In the* United States

3,541,738 Automobiles and Trucks Registered in 1916—Gain of 1,070,-143 or 44 Per Cent Over 1915

By Donald McLeod Lay

UNPRECEDENTED prosperity throughout the entire country is indicated by the statistics of automobile registration and production for 1916. There is now one automobile or motor truck to every twenty-nine persons in the United States while a year ago the ratio was one to forty-two. Breaking all records for increases in registration by a gain of over a million cars and trucks in a year, the total registration at the end of 1916, excluding all duplicate registrations, was 3,541,738, the gain for the 12 months totalling 1,070,143, or 44 per cent as compared with the registration at the end of 1915. The gain during the entire year 1915 was only 686,998, so that the increase last year was nearly double the highest preceding record.



Fifteen States with Over 200,000

A striking illustration of the phenomenal growth that has taken place is the fact that whereas only eight States were entitled to the credit of having passed the 100,000 mark in registration at the end of 1915 the close of the past year found fifteen States in this class. Moreover, New York was the only State with over 200,000 cars in 1915, but now four other States, Ohio, Illinois, Pennsylvania and California, have joined what might be characterized as the super-distinguished class, while Texas is credited with only 2313 less than this number.

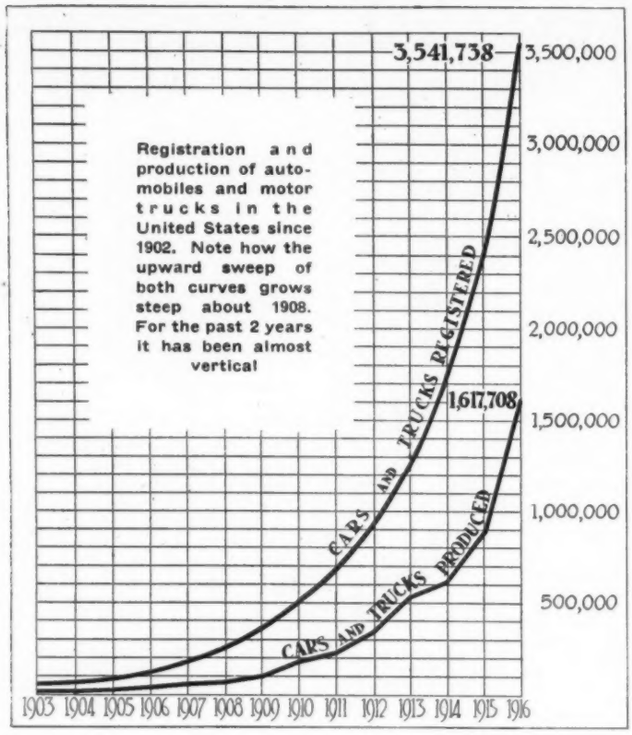
For the first time registration statistics for Texas are available, reports of the individual county clerks with whom the cars and trucks are registered having been compiled, showing a total of 197,687 motor vehicles in use in the State at the end of 1916. Last year, when only estimates were available on Texas registrations, the State was credited with only 90,000. Reports of the county clerks show that this figure should have been 137,807.

Production and registration kept pace fairly well during 1916, the National Automobile Chamber of Commerce, Inc., putting the total output for the year at 1,617,708 motor vehicles. The total retail price paid for these cars and trucks by American and foreign buyers is given as $1,088,023,273. Passenger car

Cars and Trucks in United States Jan. 1, 1917

ALL DUPLICATE REGISTRATIONS DEDUCTED

New York	279,406
Ohio	252,179
Illinois	251,300
Pennsylvania	230,648
California	212,918
Texas	197,687
Iowa	172,791
Michigan	159,639
Indiana	139,138
Minnesota	137,500
Massachusetts	136,790
Wisconsin	117,603
Kansas	114,364
Missouri	107,865
Nebraska	101,201
New Jersey	75,108
Washington	62,546
Connecticut	56,048
Oklahoma	52,718
Georgia	45,775
South Dakota	44,271
Colorado	44,180
North Dakota	41,761
Virginia	35,426
North Carolina	35,150
Maryland	33,364
Kentucky	31,500
Tennessee	31,400
Oregon	30,917
Maine	28,951
Montana	24,585
Alabama	22,354
Rhode Island	21,406
Mississippi	20,474
West Virginia	20,437
South Carolina	19,000
Louisiana	16,800
Arkansas	14,704
New Hampshire	14,338
Vermont	14,251
Florida	14,220
Utah	13,507
Dist. of Col.	13,118
Idaho	12,996
Arizona	12,122
New Mexico	8,028
Delaware	7,520
Wyoming	7,125
Nevada	4,609
Total	3,541,738


3,541,738
3,500,000
3,000,000
2,500,000
2,000,000
1,617,708
1,500,000
1,000,000
500,000
Registration and production of automobiles and motor trucks in the United States since 1902. Note how the upward sweep of both curves grows steep about 1908. For the past 2 years it has been almost vertical
CARS AND TRUCKS REGISTERED
CARS AND TRUCKS PRODUCED
1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916

1916 PRODUCTION

production was put at 1,525,578, valued at $921,378,000. Motor truck output totaled 92,130, representing $166,650,273. The average price for passenger cars was $605 and for commercial vehicles $1809.

Just as was the case a year ago, the largest increase in registration during 1916 was found to occur in the last 6 months. Analyzing the gain of 1,070,143 cars and trucks from this viewpoint and allowing for the correct registration total in Texas, the figures are:

Gain in registration to July 1.....460,860
Gain in last 6 months.....609,283

New York Still Leads

New York is still in the lead with 279,406 cars and trucks, although Ohio and Illinois have made tremendous strides, Ohio now having 252,179 registrations and Illinois 251,300, Pennsylvania ranks fourth with 230,648 and California fifth with 212,918. In the class now having between 100,000 and 200,000, Texas leads the van with 197,687, with Iowa 172,791. Michigan is the only other State with over 150,000, having 159,639. The others range from Indiana with 139,138 down to Nebraska with 101,201, after which there is an abrupt drop to New Jersey with 75,108.

Ohio Is Now Second

A comparison with the ranking of the leading States last year shows that a considerable change has taken place in their order. Ohio took second place away from Illinois during 1916, and Pennsylvania changed places with California by moving up to fourth position. Texas, due to the fact that the 1915 estimate was low, has jumped into sixth place immediately ahead of Iowa, which occupied that position last year. Michigan has been moved back to eighth place because of Texas suddenly attaining a position ahead of it, and Indiana, Minnesota, Massachusetts and Wisconsin retain their places next in order. Kansas has displaced Missouri next in position and Nebraska is now ahead of New Jersey. The way in which the Western States have been buying cars is further accentuated by Washington usurping the place held last year by Connecticut. The Southern States have also been gaining ground and Oklahoma and Georgia have jumped ahead of South Dakota, Maryland, Tennessee and Colorado.

Pennsylvania Made Largest Gain

Taking up the individual increases, Pennsylvania has made the biggest showing during the past year, having 79,919 additional cars and trucks to its credit. This was doubtless due in large measure to the large amount of war business done by the Keystone State, the high prices of steel, iron, coal, etc., but it must not be overlooked that war prices for vegetables and other farm products were responsible for much of the gain. Statistics gathered by the State department of agriculture show that one out of every six farmers in Pennsylvania owns an automobile and one out of every 100 is the possessor of a motor truck. According to the same authority, the total number of cars owned by Pennsylvania farmers is 33,268, as compared with 22,608 at the end of 1915, or an increase of almost 50 per cent. The gain for the entire State was 53 per cent.

Last year the largest increase was credited to Ohio with only 58,502 additional registrations, while Pennsylvania was fourth in rank in this respect. Ohio is still showing a remarkable number of new cars and trucks, however, ranking second this year with 72,412 new registrations, or only 7507 less than Pennsylvania. Ohio's gain was 40 per cent.

Illinois continues to hold third position in number of new registrations, adding 69,010, a gain of 38 per cent.

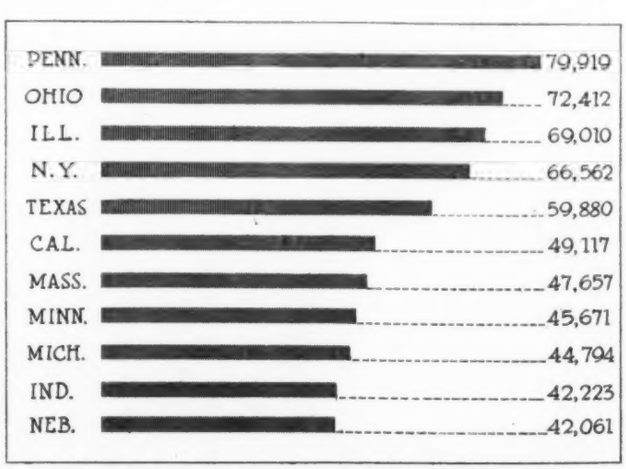
New York, which was second last year in added registrations, has now dropped to fourth place with 66,562, a gain of 31 per cent, which is a considerable achievement when its enormous total registration is considered.

Texas has made a remarkable stride, having added 59,880 motor vehicles to its lists during 1916, this gain being based on the actual registration figures without regard to the estimate of 90,000 total registration for 1915, which was found to be so over-conservative. The Texas increase was thus 43 per cent.

California ranks next to Texas in number of new registrations, having 49,117, a gain of 30 per cent, and leading Massachusetts, which is credited with 47,657, or an increase of 53 per cent, and Minnesota with 45,671, a 50 per cent gain.

Others showing over 40,000 increased registrations for the year are Michigan with 44,794, a gain of 39 per cent, Indiana with 43,223, 44 per cent, and Nebraska 42,061, or 71 per cent.

Many phenomenal percentage gains in the States having fewer registrations are shown by glancing down the column of increases on page 552. Thus it will be noted that Nevada has added 111 per cent, enabling it to rise one place from the



Eleven States showed gains of over 40,000 registrations of cars and trucks during 1916

Distribution of automobile and motor trucks in the various States, all duplicate registrations being deducted

Car and Truck Registration in Each State from Jan. 1, 1916, to Jan. 1, 1917

State or Territory	Total Registration	New Registration	Registration Up to Jan. 1 1916	Gasoline Passenger Cars in Use	Gasoline Commercial Cars in Use	Non-Resident Registration*	Re-Registered**	Chauffeurs Registered	Car License Fees	Total Fees	Remarks
Alabama	22,354	8,556	13,798	18,759	3,595	***	***	1,600	$134,616	$136,616	
Arizona	12,122	4,802	7,320	***	***	***	***	***	***	***	
Arkansas	14,979	6,958	8,021	***	***	***	275	500	149,790	150,290	
California	232,186	68,385	163,801	***	***	1,999	17,269	14,587	2,077,720	2,134,200	
Colorado	44,180	17,569	26,611	***	***	***	***	6,881	183,645	190,526	
Connecticut	56,048	17,098	38,950	***	7,759	***	***	612	***	624,767	
Delaware	7,520	2,596	4,924	***	***	***	***	6,565	38,354	83,094	
Dist. of Col	13,118	2,918	10,200	12,203	900	***	***	***	24,690	45,830	Perennial registration
Florida	14,220	1,097	13,123	***	***	***	***	***	***	***	
Georgia	46,025	21,966	24,059	42,525	3,500	250	None	3,653	197,565	154,735	
Idaho	13,283	6,190	7,093	***	***	***	287	1,094	207,505	213,758	
Illinois	251,300	69,010	182,290	***	***	***	***	33,022	***	1,236,566	
Indiana	139,138	42,223	96,915	***	***	***	***	4,348	755,306	817,286	
Iowa	198,587	58,779	139,808	***	***	50	25,746	None	***	1,915,895	
Kansas	114,364	39,408	74,956	***	***	***	***	None	571,820	586,242	
Kentucky	31,500	12,000	19,500	***	***	***	***	***	185,000	188,000	
Louisiana	16,800	5,920	10,880	***	***	***	***	***	***	***	
Maine	30,951	12,351	18,600	28,960	1,991	***	2,000	***	***	350,000	
Maryland	43,864	16,226	27,638	***	***	9,500	1,000	10,000	441,638	565,302	
Massachusetts	136,809	47,676	89,133	118,596	18,194	19	***	10,928	1,238,377	1,564,353	
Michigan	160,052	45,207	114,845	148,692	11,360	413	***	11,282	1,643,679	1,739,344	
Minnesota	138,000	46,171	91,829	***	***	500	***	4,100	207,000	213,000	Triennial registration
Mississippi	20,474	8,974	11,500	***	***	***	***	***	***	184,296	
Missouri	107,865	31,403	76,462	***	***	***	***	***	***	***	
Montana	24,585	10,065	14,520	***	***	***	***	336	89,170	89,842	
Nebraska	101,201	42,061	59,140	***	* *	***	***	***	***	***	
Nevada	4,672	2,495	2,177	4,466	206	25	38	***	21,615	21,615	
New Hampshire	17,508	6,689	10,819	***	***	1,170	2,000	6,200	270,638	348,408	
New Jersey	104,341	36,785	67,556	***	***	***	29,233	***	885,009	1,402,067	
New Mexico	8,228	3,281	4,947	8,078	150	None	200	None	***	47,865	
New York	316,543	103,699	212,844	***	***	3,057	34,080	104,720	2,174,555	2,587,633	
North Carolina	35,200	14,040	21,160	***	***	50	***	None	***	206,101	
North Dakota	41,761	17,083	24,678	***	***	***	***	***	***	121,481	
Ohio	258,409	78,642	179,767	251,944	6,465	174	6,056	***	***	1,286,546	
Oklahoma	52,718	27,103	25,615	***	***	***	***	***	555,012	555,012	
Oregon	33,917	10,159	23,758	***	***	***	3,000	4,019	121,204	146,232	
Pennsylvania	230,648	79,919	150,729	218,916	11,732	***	***	49,528	1,908,378	2,325,058	
Rhode Island	21,406	5,044	16,362	18,551	2,855	***	***	***	***	203,170	
South Carolina†	19,000	4,500	14,500	17,000	2,000	***	***	***	***	***	Local registration
South Dakota	44,271	14,935	29,336	***	***	***	***	***	***	***	
Tennessee	31,700	4,434	27,266	***	***	***	300	None	199,000	199,000	
Texas††	197,687	59,880	137,807	***	***	***	***	***	***	***	New law
Utah	13,507	5,513	7,994	***	***	***	***	***	***	93,494	Perennial
Vermont	15,671	4,172	11,499	14,943	728	***	1,420	4,000	258,538	297,992	
Virginia	35,426	14,069	21,357	***	***	***	***	3,000	***	280,000	
Washington	62,546	25,641	36,905	***	***	None	None	***	350,052	350,052	
West Virginia	20,437	7,181	13,256	***	***	***	***	1,953	***	197,848	
Wisconsin	117,603	36,232	81,371	113,703	3,900	***	***	***	***	***	
Wyoming	7,125	3,149	3,976	***	***	None	None	None	35,625	35,651	
Total	3,681,849	1,210,254	2,471,595	1,017,336	75,335	17,207	122,904	282,928	$14,925,502	23,889,167	

NOTE.—Steam cars and trucks, as well as electric vehicles, included with the gasoline vehicle statistics as segregation is not carried out by registration officials. *Number of cars registered owned by citizens of other states. **Number of cars re-registered owing to transfer of ownership, etc. ***Statistics not available. †Estimated by state registration officials. ††Texas statistics for Jan. 1, 1916, now available, 137,807; previous estimate was only 90,000.

bottom position in the list of increases by number of vehicles. Oklahoma has gained 106 per cent, Florida 84, Idaho 83, Wyoming 79, and Mississippi 78.

It is worth noting, as a characteristic feature of the gain made in registration during the past year, that, whereas at the end of 1915 it was pointed out with considerable pride that thirteen of the States could boast increases of 20,000 or over, the eleven leading States in this respect in 1916 each had over 40,000 new registrations to its credit and seven others were beyond the 20,000 mark.

Increase in Registration

State	Increase in Cars	Per Cent Increase
Pennsylvania	79,919	53
Ohio	72,412	40
Illinois	69,010	38
New York	66,562	31
Texas	59,880	43
California	49,117	30
Massachusetts	47,657	53
Minnesota	45,671	50
Michigan	44,794	39
Indiana	42,223	44
Nebraska	42,061	71
Kansas	39,408	53
Wisconsin	36,232	45
Iowa	32,983	24
Missouri	31,403	41
Oklahoma	27,103	106
Washington	25,641	69
Georgia	21,716	90
Colorado	17,569	65
Connecticut	17,098	35
North Dakota	17,083	69
South Dakota	14,935	50
Virginia	14,069	66
North Carolina	13,990	65
Kentucky	12,000	61
Maine	10,351	55
Montana	10,065	69
Mississippi	8,974	78
Alabama	8,556	69
New Jersey	7,552	11
West Virginia	7,181	54
Oregon	7,159	30
Arkansas	6,683	83
Louisiana	5,920	54
Idaho	5,903	83
Maryland	5,726	27
Utah	5,513	69
Rhode Island	5,044	31
Arizona	4,802	65
South Carolina	4,500	31
Tennessee	4,134	15
New Hampshire	3,519	32
Wyoming	3,149	79
New Mexico	3,081	68
Dist. of Columbia	2,918	28
Vermont	2,752	24
Delaware	2,596	53
Nevada	2,432	111
Florida	1,097	84
Total	1,070,143	
Average increase		44

Registration and Population

State	Pop. July 1, 1916 Census	Cars and Trucks	Pop. Per Car
Iowa	2,220,321	172,791	13
Nebraska	1,271,375	101,201	13
California	2,938,654	212,918	14
Kansas	1,829,545	114,364	16
South Dakota	698,509	44,271	16
Minnesota	2,279,603	137,500	17
North Dakota	739,201	41,761	18
Arizona	255,544	12,122	19
Michigan	3,054,854	159,639	19
Montana	459,494	24,585	19
Indiana	2,816,817	139,138	20
Ohio	5,150,356	252,179	20
Wisconsin	2,500,350	117,603	21
Colorado	962,060	44,180	22
Connecticut	1,244,479	56,048	22
Texas	4,429,566	197,687	22
Nevada	106,734	4,609	23
Wyoming	179,559	7,125	25
Illinois	6,152,257	251,300	25
Washington	1,534,221	62,546	25
Vermont	363,699	14,251	26
Maine	772,489	28,951	27
Massachusetts	3,719,156	136,790	27
Oregon	835,741	30,917	27
Delaware	213,380	7,520	28
Dist. of Col.	363,980	13,118	28
Rhode Island	614,315	21,406	29
New Hampshire	442,506	14,338	31
Missouri	3,410,692	107,865	32
Utah	434,083	13,507	32
Idaho	428,586	12,996	33
Pennsylvania	8,522,017	230,648	37
New York	10,273,375	279,406	37
New Jersey	2,948,017	75,108	39
Maryland	1,362,807	33,364	41
Oklahoma	2,202,081	52,718	42
New Mexico	410,283	8,028	50
Virginia	2,192,019	35,426	62
Georgia	2,856,065	45,775	62
Florida	893,493	14,220	63
North Carolina	2,402,738	35,150	68
West Virginia	1,386,038	20,437	68
Tennessee	2,288,004	31,400	73
Kentucky	2,379,639	31,500	76
South Carolina	1,625,475	19,000	86
Mississippi	1,951,674	20,474	95
Alabama	2,332,608	22,354	104
Louisiana	1,829,130	16,800	108
Arkansas	1,739,723	14,704	118
Total	102,017,312	3,451,738	
Average for U. S.			29

Iowa still has the most cars and trucks compared with population of any State in the Union, having only thirteen persons for each motor vehicle, or less than half the average population per car for the entire country. Last year Iowa led with sixteen persons per car. The fact that this rich agricultural State has been able to attain this ratio without any evidence of saturation shows what may be accomplished in the other States, although it must be admitted that the number of people per motor vehicle has been reduced in a most strikingly uniform manner throughout the country during the past 12 months.

Iowa and Nebraska Lead

Nebraska has attained the same ratio as Iowa, having only thirteen people per car, but is ranked second because both the population and the registration are smaller.

California is a close third, with but fourteen persons to each motor vehicle. Kansas and South Dakota rank next with the same ratio of sixteen people per car. Minnesota has seventeen, North Dakota eighteen and Arizona, Michigan and Montana each nineteen. From this point the number increases from Indiana and Ohio with twenty people per car through fifteen other States having over twenty but less than thirty, seven with thirty to forty and the rest ranging up to ninety-five, except Alabama, which has 104, Louisiana 108 and Arkansas 118. A glance at the tabulation of registration and population in each State published herewith suffices to bring out the fact that all the States having over forty people per car are located in the South. It is undoubtedly the large impecunious

Dealers, Garages, Machine Shops and Supply Houses in the United States

State	Dealers	Garages	Machine Shops	Cos. Having Supply Dept.	Supplies Exclusively	Total
Alabama	172	109	74	37	35	278
Arizona	86	82	51	24	12	152
Arkansas	174	96	59	29	18	245
California	1096	1211	739	200	151	2032
Colorado	346	312	177	80	22	520
Connecticut	394	431	211	50	70	713
Delaware	65	62	27	11	5	90
Dist. of Columbia	57	56	36	8	24	140
Florida	246	272	163	64	45	464
Georgia	315	266	123	33	46	549
Idaho	151	100	53	23	19	207
Illinois	1857	1645	968	390	131	2889
Indiana	984	795	409	247	65	1497
Iowa	1619	1322	681	360	64	2196
Kansas	986	774	380	266	33	1445
Kentucky	291	230	82	62	24	413
Louisiana	120	67	45	31	18	170
Maine	279	262	124	80	19	456
Maryland	222	242	125	75	36	403
Massachusetts	771	828	421	180	141	1520
Michigan	986	822	349	132	88	1535
Minnesota	1155	833	458	271	59	1550
Mississippi	133	84	50	40	13	193
Missouri	810	639	413	222	81	1310
Montana	240	205	117	60	14	345
Nebraska	810	647	285	218	29	1091
Nevada	57	52	28	19	4	84
New Hampshire	192	214	107	59	10	319
New Mexico	102	73	42	33	78	223
New Jersey	621	844	411	192	6	1170
New York	2003	2217	1172	456	321	3735
North Carolina	306	233	111	85	21	421
North Dakota	537	339	198	119	9	703
Ohio	931	1317	542	425	172	2589
Oklahoma	386	311	125	136	27	581
Oregon	205	231	130	49	30	315
Pennsylvania	1677	1682	776	452	113	2673
Rhode Island	85	141	91	16	19	262
South Carolina	156	113	58	48	19	218
South Dakota	442	308	155	35	7	584
Tennessee	188	136	75	20	40	285
Texas	626	488	267	47	87	1059
Utah	88	62	33	15	15	143
Vermont	187	156	83	33	11	286
Virginia	230	158	111	41	44	391
Washington	356	318	168	25	54	599
West Virginia	199	143	52	24	13	246
Wisconsin	1016	874	410	135	47	182
Wyoming	76	56	37	13	2	103
Hawaii	6	7	3	....	1	9
West Indies	25	20	5	1	1	32
Canada	854	760	358	3	95	1252
Mexico	8	11	3	1	2	15
Total	25,924	23,686	12,171	5,675	2,503	40,912

negro element in their population which is responsible for the comparatively small registration for motor vehicles on a population basis.

War Order Factor Reduced

The war order business which was so great a factor in the 1915 car and truck market was reduced to much smaller proportions in 1916, so that it consisted largely of trucks and tractors. The export trade of the United States in automobiles and trucks increased, however, to an appreciable extent with the countries of South America, South Africa, Australia, Asia and neutral Europe. From all indications, the possibilities of export trade for the American automobile industry are almost unlimited and our manufacturers are only beginning to take advantage of their opportunities.

Sixty-three More Manufacturers

The number of automobile, motor truck and engine manufacturers in the country has increased from 512 to 575 during the past year. This gain is entirely due to the expansion which has characterized the commercial vehicle industry, the number of makers in this field now being 364, as compared with 267 last year. There is only one more automobile company and there are ten fewer engine makers. These statistics were compiled by *The Automobile Trade Directory*, the geographical distribution of the plants being shown in the accompanying tabulation.

Distribution of Car, Truck and Engine Manufacturers in the United States

State	Automobiles	Commercial Vehicles	Engines	Total
California	4	14	..	18
Colorado	1	..	..	1
Connecticut	4	3	2	8
Delaware	..	..	..	..
Dist. of Columbia	..	1	..	1
Georgia	..	2	..	2
Illinois	23	43	4	62
Indiana	26	12	5	39
Iowa	1	11	..	11
Kansas	1	1	..	2
Kentucky	2	3	..	4
Louisiana	1	1	..	2
Maine	..	1	..	1
Maryland	2	2	..	2
Massachusetts	7	14	..	17
Michigan	47	43	14	99
Minnesota	3	36	..	37
Missouri	5	9	..	13
Nebraska	1	2	..	3
New Hampshire	..	1	..	1
New Jersey	3	7	..	10
New York	22	43	6	65
North Carolina	..	1	..	5
Ohio	34	48	5	75
Oregon	1	..	..	1
Pennsylvania	13	27	7	42
Rhode Island	..	1	..	1
Texas	1	1	..	2
Virginia	1	1	..	2
Washington	2	5	..	5
West Virginia	1	2	..	3
Wisconsin	6	14	7	25
Canada	19	15	1	27
Total	231	364	51	575

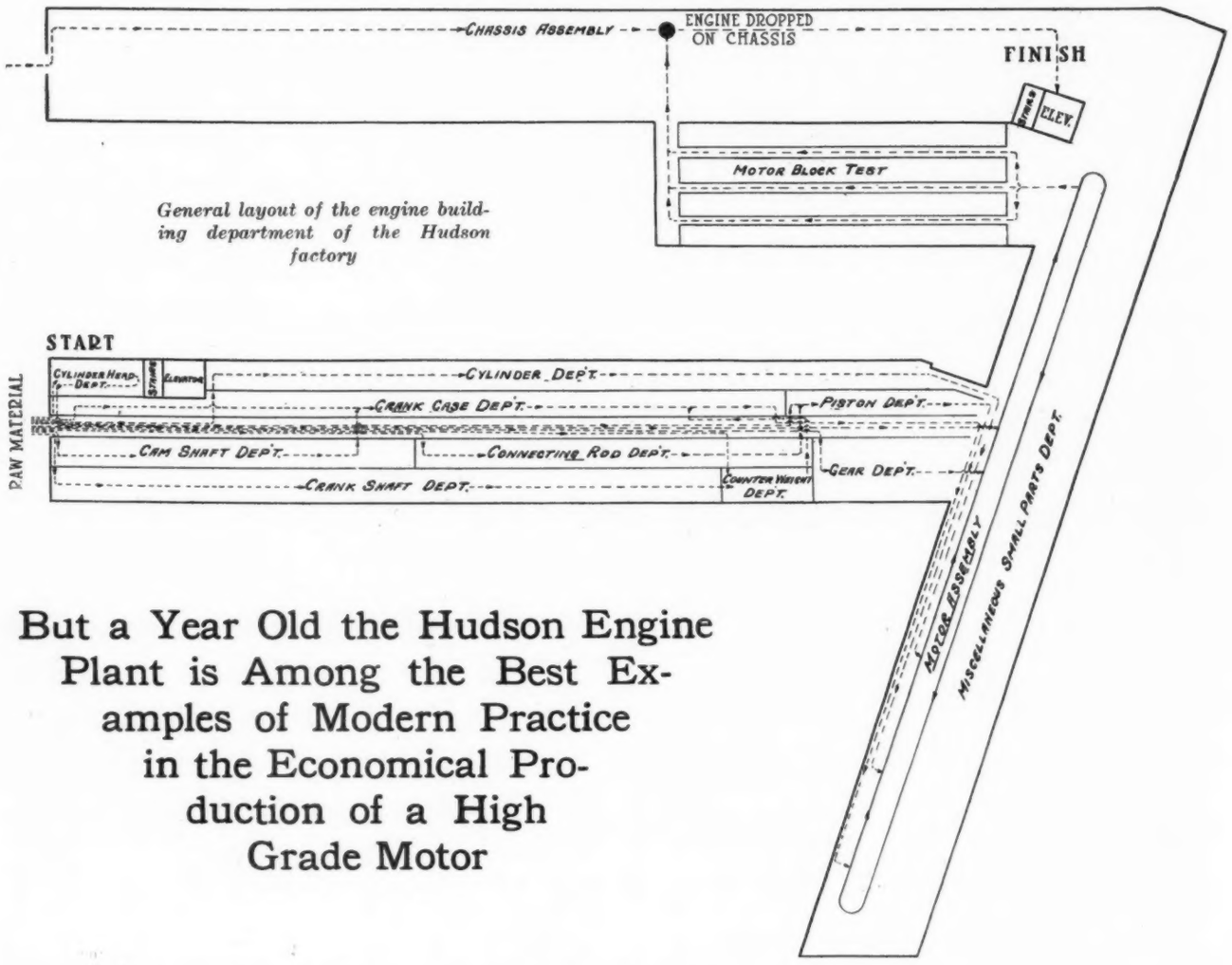
Texas Registration, By Counties, Shows 42½% Gain

Statistics from Reports of County Clerks for 1916

Counties	Car licenses 1915	Car licenses 1916	Per Cent Gain
Anderson	424	639	50
Andrews	34	38	12
Arkansas	104	126	21
Archer	146	258	69
Armstrong	213	328	54
Atascosa	189	300	59
Austin	284	522	84
Bandera	68	121	78
Bastrop	410	627	53
Baylor	288	444	54
Bee	371	448	20
Bell	1,525	2,325	52
Bexar	8,975	11,564	29
Blanco	188	241	28
Borden	63	78	24
Bosque	688	954	38
Bowie	558	849	52
Brazoria	351	525	50
Brazos	261	461	77
Briscoe	165	248	50
Brooks	94	111	18
Brown	701	1,068	52
Burleson	232	396	70
Burnett	386	540	40
Caldwell	629	973	55
Calhoun	123	167	21
Callahan	283	517	93
Cameron	832	1,073	29
Camp	106	172	62
Carson	255	356	39
Cass	156	297	90
Castro	126	185	47
Chambers	156	212	56
Cherokee	289	530	83
Childress	458	668	46
Clay	488	767	57
Coke	144	222	54
Coleman	455	817	79
Collin	1,389	2,083	50
Collinsworth	245	433	77
Colorado	390	594	52
Comal	475	641	35
Comanche	336	604	79
Concho	183	315	72
Cooke	547	789	44
Coryell	560	871	56
Cottle	149	247	66
Crockett	161	185	15
Culberson	57	77	35
Dallam	245	353	44
Dallas	12,715	16,550	30
Dawson	132	238	80
Deaf Smith	362	488	35
Delta	358	536	50
Denton	1,013	1,329	31
Dewitt	833	1,230	39
Dickens	122	227	86
Dimmitt	166	232	40
Donley	325	465	43
Duvall	75	93	24
Eastland	358	520	45
Ector	No 1916 report		
Edwards	133	165	46
Ellis	2,182	3,246	49
El Paso	5,694	8,161	43
Erath	559	795	42
Falls	721	1,161	61
Fannin	815	1,219	49
Fayette	652	977	50
Fisher	432	700	62
Floyd	413	660	60
Fort Bend	378	514	36
Franklin	46	100	117
Freestone	257	371	44
Frio	280	349	25
Gaines	83	119	4
Galveston	2,836	3,365	19
Garza	156	246	58
Gillespie	416	678	63
Glasscock	71	94	32
Goliad	245	362	48
Gonzales	566	929	64
Gray	303	429	41
Grayson	1,919	2,700	41
Gregg	230	310	35
Grimes	216	354	64
Guadalupe	796	1,200	63
Hale	843	1,146	36
Hall	504	796	58
Hamilton	617	862	58
Hansford	118	177	50
Hardeman	444	774	74
Hardin	404	606	50
Harris	9,250	12,073	30
Harrison	510	803	57
Hartley	58	89	53
Haskell	427	700	63
Hayes	484	670	35
Hemphill	199	304	53
Henderson	98	244	148
Hidalgo	537	819	53
Hill	1,525	2,283	49
Hood	143	247	72
Hopkins	368	636	73
Houston	162	333	106
Howard	426	640	50
Hunt	1,123	1,646	47
Hutchinson	54	83	52
Irion	90	138	53
Jack	187	285	52
Jackson	231	281	22
Jasper	140	252	80
Jeff Davis	92	110	20
Jefferson	2,862	3,772	32
Jim Hogg	31	48	55
Jim Wells	173	202	17
Johnson	930	1,429	50
Jones	774	1,277	65
Karnes	540	735	36
Kaufman	813	1,314	62
Kendall	309	424	37
Kent	102	170	67
Kerr	263	374	42
Kimball	125	215	72
King	30	40	33
Kinney	82	108	32
Kleburg	180	222	23
Knox	342	568	66
Lamar	1,082	1,604	48
Lamb	66	95	44
Lampasas	337	529	57
Lasalle	167	202	21
Lavaca	560	821	46
Lee	148	225	52
Loon	119	205	72
Liberty	164	288	76
Limestone	742	1,120	51
Lipscomb	264	430	63
Live Oak	71	104	46
Llano	228	350	53
Lubbock	516	740	43
McCulloch	444	653	47
McLennan	3,480	4,913	42
McMullen	28	38	36
Madison	73	156	114
Marion	40	83	107
Martin	90	115	27
Mason	216	356	65
Matagorda	508	659	30
Maverick	254	383	51
Medina	540	681	26
Menard	148	226	53
Midland	390	463	18
Milan	507	995	67
Mills	237	390	65
Mitchell	380	530	39
Montague	425	638	50
Montgomery	88	199	126
Moore	63	87	38
Morris	66	188	79
Motley	130	185	42
Nacogdoches	273	432	58
Navarre	1,471	2,273	54
Newton	93	182	96
Nolan	494	688	39
Nueces	1,157	1,343	16
Ochiltree	182	326	79
Oldham	61	86	41
Orange	340	521	52
Pal Pinto	574	823	44
Panola	92	222	132
Parker	649	864	33
Palmer	146	198	36
Pecos	224	305	36
Polk	107	183	71
Potter	1,182	1,551	31
Presidio	181	230	27
Raines	62	95	53
Randall	250	371	48
Riggin	40	59	48
Red River	434	646	49
Reeves	282	363	29
Refugio	No 1916 report	166	
Roberts	158	209	32
Robertson	275	384	39
Rockwall	326	460	41
Runnells	763	1,163	52
Rusk	120	286	138
Sabine	112	190	69
San Jacinto	13	50	284
San Patricio	380	450	18
San Saba	269	425	58
Schleicher	140	172	23
Scurry	336	516	45
Shackleford	215	330	53
Shelby	171	361	111
Sherman	144	235	63
Smith	480	851	79
Somerville	59	85	44
Starr	85	117	38
Stephens	140	245	75
Sterling	110	143	29
Stonewall	177	25	46
Sutton	182	225	24
Swisher	340	490	44
Tarrant	7,003	10,035	43
Taylor	1,169	1,655	42
Terrell	45	71	58
Terry	83	147	77
Throckmorton	155	252	63
Titus	117	214	83
Tom Groom	1,244	1,638	32
Travis	2,838	3,643	28
Trinity	101	187	85
Titus	28	68	143
Upshur	159	298	87
Upton	24	24	17
Uvalde	515	647	26
Val Verde	430	543	26
Van Zandt	303	557	83
Victoria	520	615	18
Walker	89	168	88
Waller	138	252	82
Ward	74	113	51
Washington	480	686	43
Webb	No 1916 report	881	
Wharton	520	769	43
Wheeler	213	322	51
Wichita	1,834	2,788	52
Wilbarger	625	1,030	65
Willacy	10	12	20
Williamson	2,048	2,846	39
Wilson	359	591	65
Winkler	4	12	200
Wise	350	551	59
Wood	217	352	62
Yoakum	47	60	28
Young	321	479	49
Zapata	37	40	8
Zavala	124	155	25
Total	137,807	197,687	

Average increase, 42½ per cent.

Making the Super-Six



General layout of the engine building department of the Hudson factory

But a Year Old the Hudson Engine Plant is Among the Best Examples of Modern Practice in the Economical Production of a High Grade Motor

IF you held the letter F in front of a mirror, it would give you a rough general map of the course taken by the Hudson engine in its manufacturing process. In general, the system employed is a sort of series parallel, as well as progressive, although the engine is not compelled to retrace its steps from the time it starts as raw material until, in its finished condition, it drops on the chassis. At the same time it is not necessary to string the entire manufacture out in a long line, which would give unwieldy factory conditions. The layout is such that every part is done in its own particular department, and when the engine is finally ready, having passed all its inspections and tests, it meets the chassis assembly at the proper point, so that it can be dropped immediately in place without delay.

The whole scheme of manufacture is a question of meeting schedules in all departments. The machines are so timed and the quantities are so arranged that each part follows a time table and all meet at the proper points as regularly as if they were run through by automatic machinery. In fact, in many departments it is necessary that this time-table arrangement hold true so that predetermined sub-assembly can come together at the right time.

The general layout is shown in the accompanying map with arrows indicating the direction each part takes on its way from raw material to finished condition.

It will be noted that the cylinders and crankcases run along two parallel lines of the manufacturing building on one side, while the camshaft and connecting-rod parallel the crankshaft on the other side. Running along these four parallel lines of manufacture, the machinery is so arranged that at the end of the line they all come out even, manufactured in each department in the proper numbers so that there is a uniformity of output throughout the entire plan.

Three Engine Castings

In the Hudson engine there are two main iron castings and an aluminum casting, making up the skeleton. These are the cylinder block, the cylinder head, and the crankcase. Both the cylinder head and the cylinder block castings are allowed to age from 3 weeks to a month in the open air before they are started through manufacture.

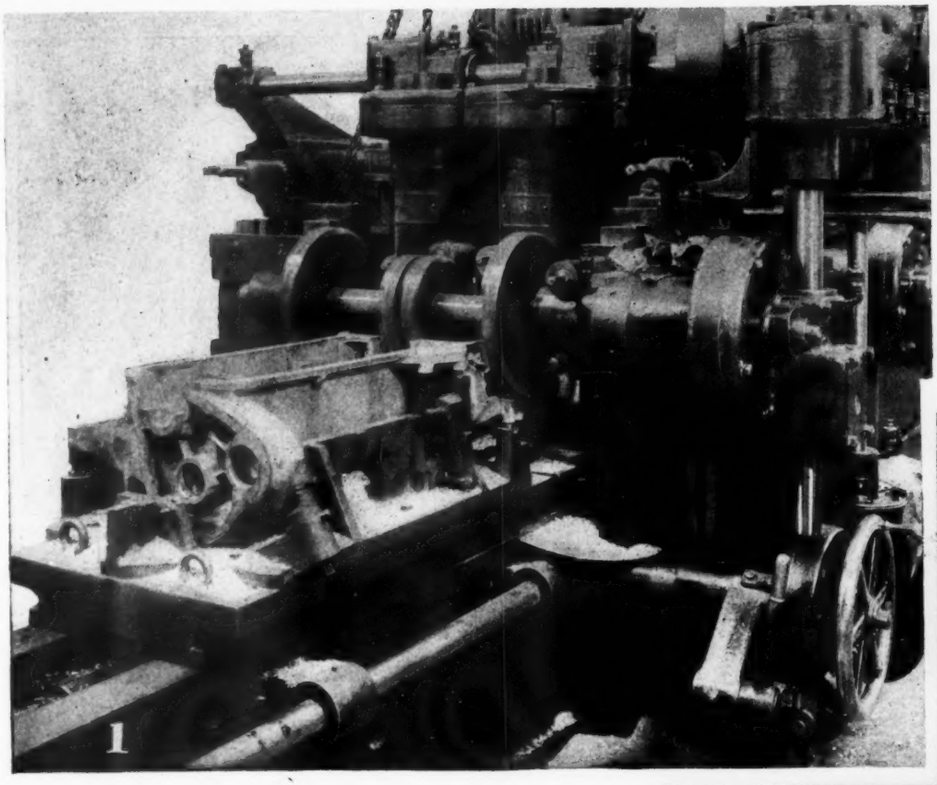


Fig. 1—Roughing and finishing oil pan face of crankcase

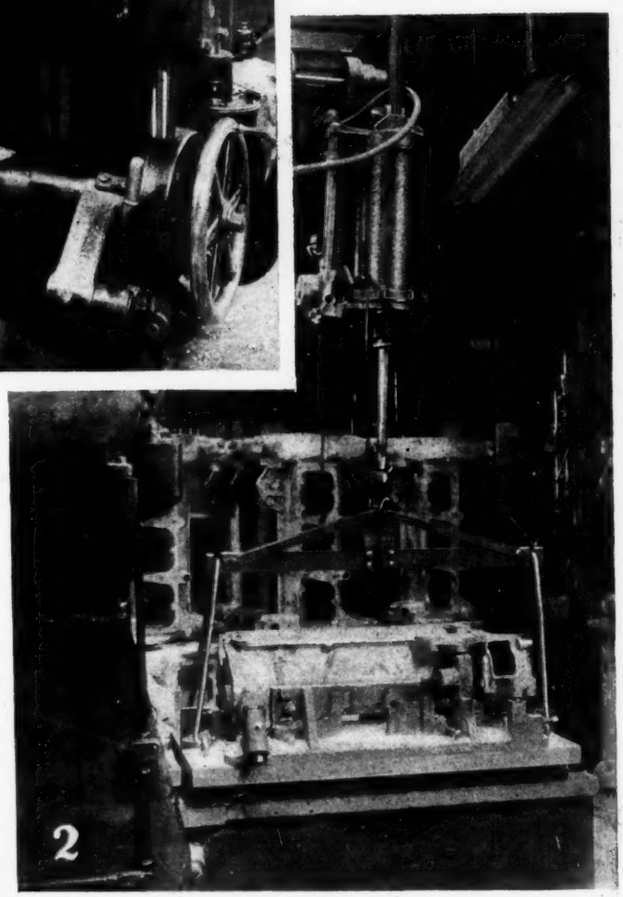


Fig. 2—Air hoist and track for jig and case on crankcase milling machine

The cylinder head is a simple matter. It is a flat iron casting which requires but little work and hence occupies but a small department, as indicated in the accompanying map, almost at the entrance of the engine manufacturing department. The heads are quickly finished, being simply milled on both sides in the same jig, which is first run through the milling machine on one side and then turned over and run on the other side. The head is then drilled on a multiple spindle machine and passed along to the next drill for holes entering from other directions. It is drilled and tapped for the spark plugs, tapped for the water jacket outlet, and is then completed and can then be passed along ready for the time it is required for assembly.

Aluminum Castings Are Checked

On the aluminum crankcase the operations are somewhat more complicated. It is first checked to see that there is enough material in the case to give the proper amount of metal behind the bearings after all the milling operations have taken place. The machine in Fig. 1 is shown roughing and finishing the oil pan face of the crankcase. It requires two milling operations. The first, which really establishes the alignment of the entire engine, is made immediately. This is an automatic machine requiring 14 min. to do a crankcase. The jig is then picked up by an air hoist shown in Fig. 2, carried around and run through the machine again to face off the opposite surface. The second face to be milled is for the cylinders, and this requires, also, both a rough and finish-machining. The bearing seats are then faced, and this process locates them endwise in the crankcase.

Before any drilling is carried on there are two holes drilled and reamed in the crankcase at diagonal points. These are the dowel pin holes as shown in Fig. 4. They serve as locating points for all the other holes which are drilled in the case.

One of the interesting studies in the manufacture of the crankcase, as well as other parts of the Hudson engine, is in the method used in locating the machining operations. For instance, the bearing surfaces are not located by the motor feet, as is quite customary, but by the camshaft hole. The multiple drilling operation, after being located by means of jigs which are trued up by the dowel pin holes, is carried along on a track system which carries the crankcase to three multiple spindles. In this, the same jig is used for all three drilling sets.

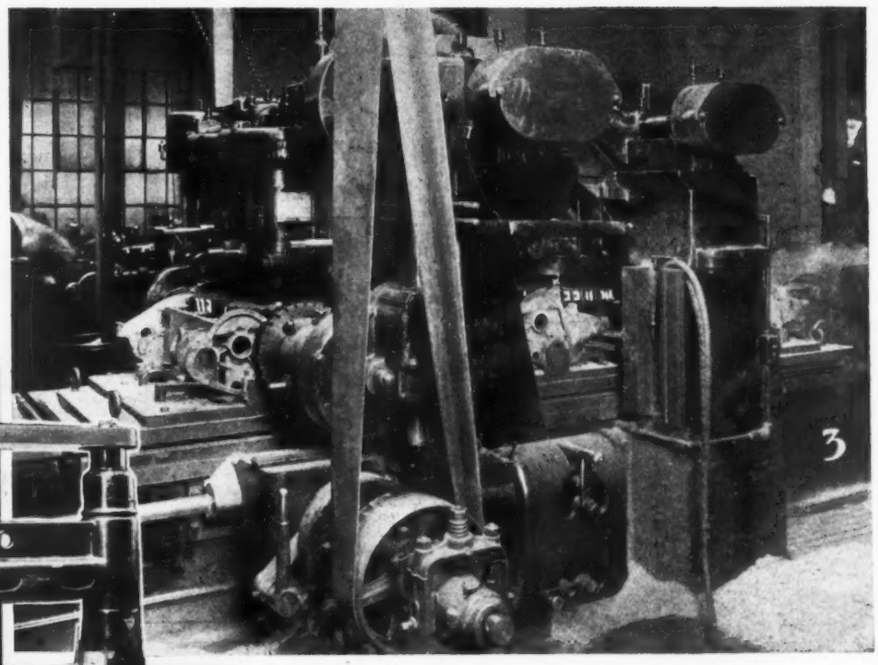
Crank Case Group Drilling

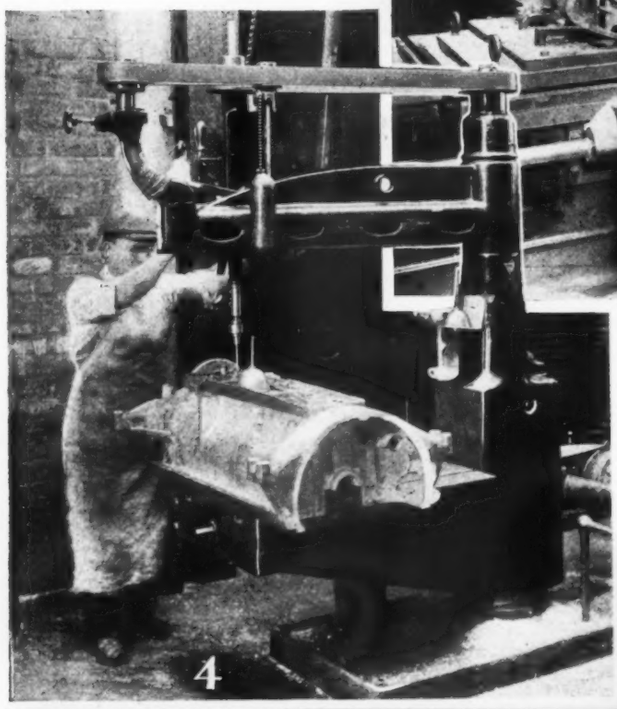
This set of spindle drills, together with the tracks and the switch-back mechanism at the end, is shown in Fig. 5. The drills finish up this kind of work on the case as far as it can be done by multiple machinery. The principal holes are those for the cylinder bolts and also for the distributor drive. There is a special job, however, which has to be done on a radial machine. This is done with a jig and consists in drilling and counter-

Fig. 3—Milling Machine, roughing and finishing, for 3 faces on crankcase

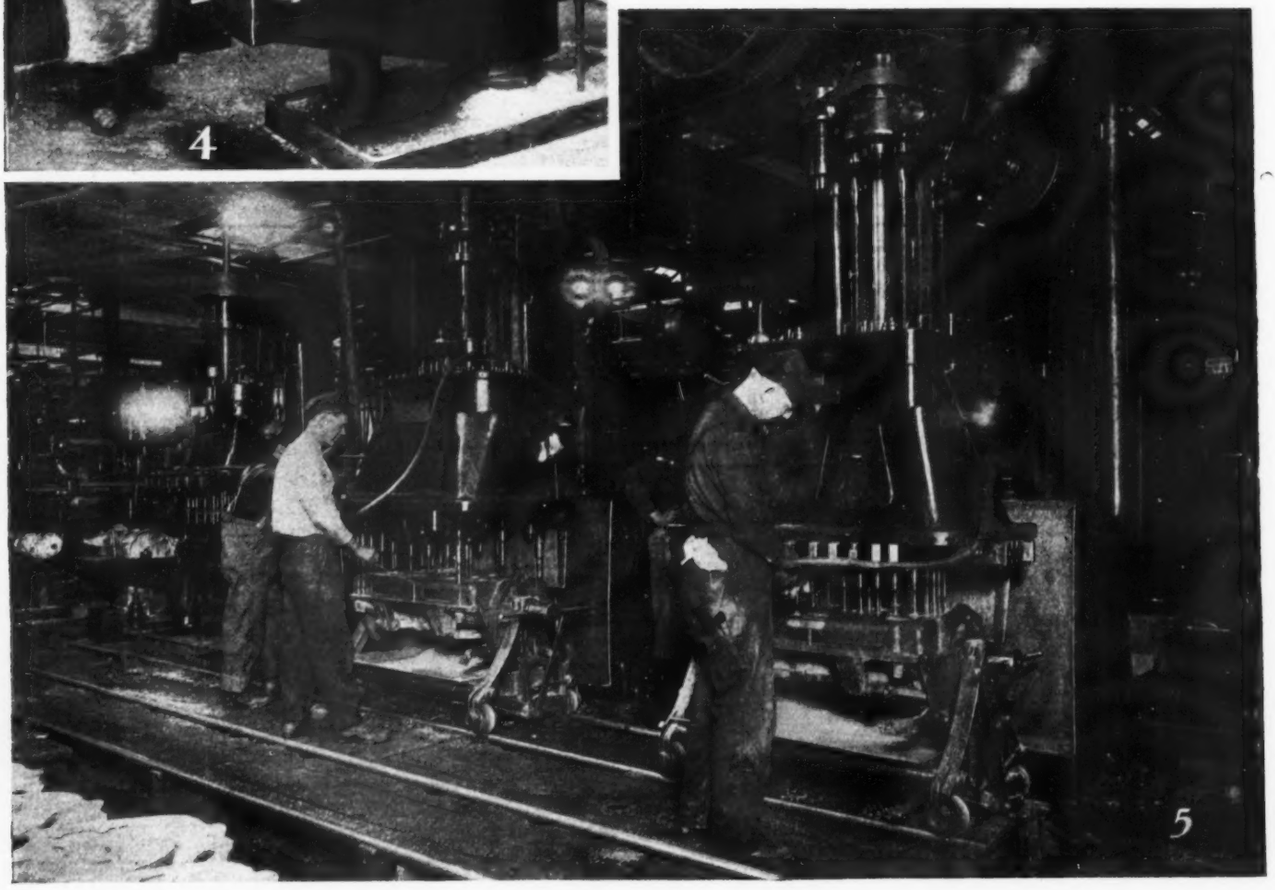
Fig. 4—Drilling and reaming dowel pin holes in crankcase

Fig. 5—Drilling all holes in crankcase





Principal Operations on Hudson Crankcase Which Follow Milling



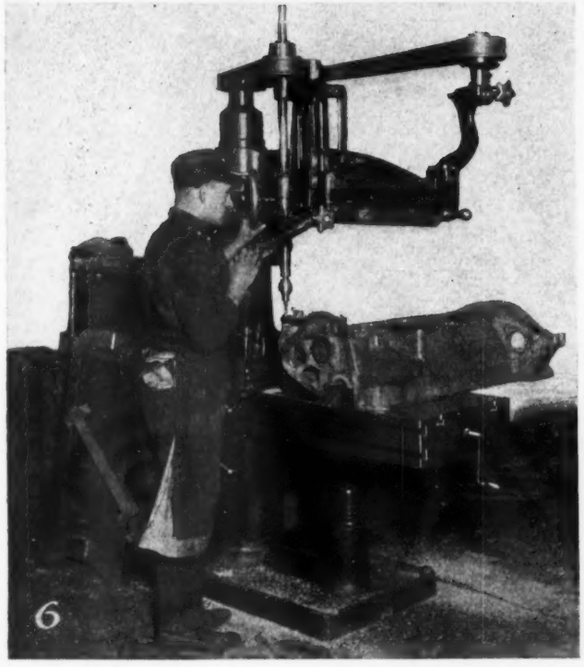
Final Operations on Hudson Crankcase

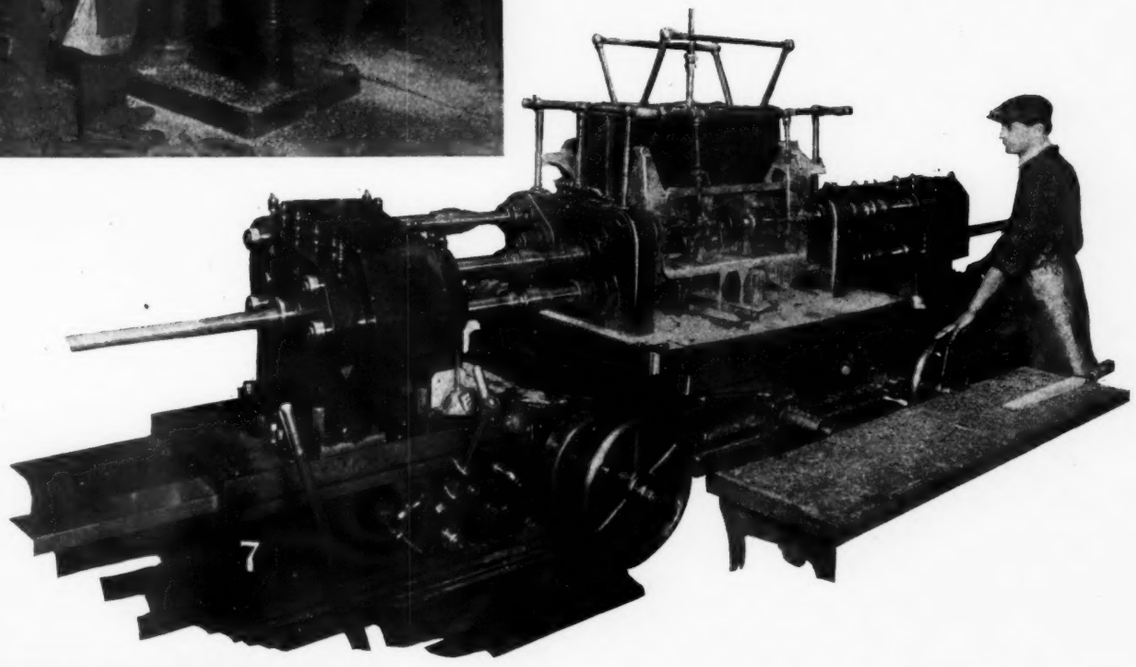
Fig. 6—Drilling and tapping holes for distributor brackets

Fig. 7—Rough and finish boring camshaft and crankshaft holes in crankcase

Fig. 8—Final inspection on crankcase before assembly

Fig. 9—Boring and reaming babbitt bearings in crankcase





sinking some of the additional holes on the case. The time required for this special operation is 1¼ min. on a Strelinger radial drill, as shown in Fig. 6. This is the last machining operation on the crankcase. They are then cleaned in boiling water and turned over for hand work, the first step being the mounting of the bearing studs. After this the caps are put in place, these having been made in small subdepartments running toward the crankcase department. They are put on immediately after the studs are in place and then bored on a boring machine for both the crankshaft and camshaft holes at the same time. This machine operates efficiently and accurately because it not only bores both these holes at the same time, but handles two cases at once, and since the operation is carried on coincidentally, perfect alignment is sure to be secured as well as quick time. This machine is shown in operation in Fig. 7. There are four boring cutters, two on each side of the machine. The front and back covers for the crankcase are both drilled at the same time, on the same machine.

Another interesting machine operating on the crankcase is one which mills out the clearance for the cam gear and faces off the lugs so that this gear has its proper amount of distance from the case. The crankcase end plates and the bearings are then

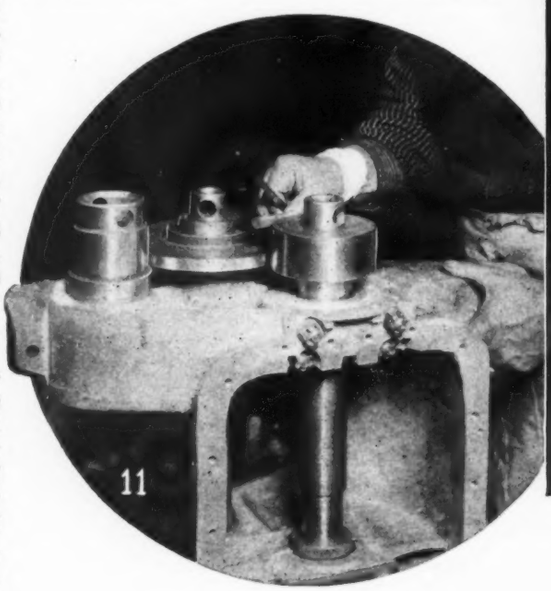


Fig. 10—Testing camshaft bores, and

Fig. 11—Inspecting crankcases for gear center distance

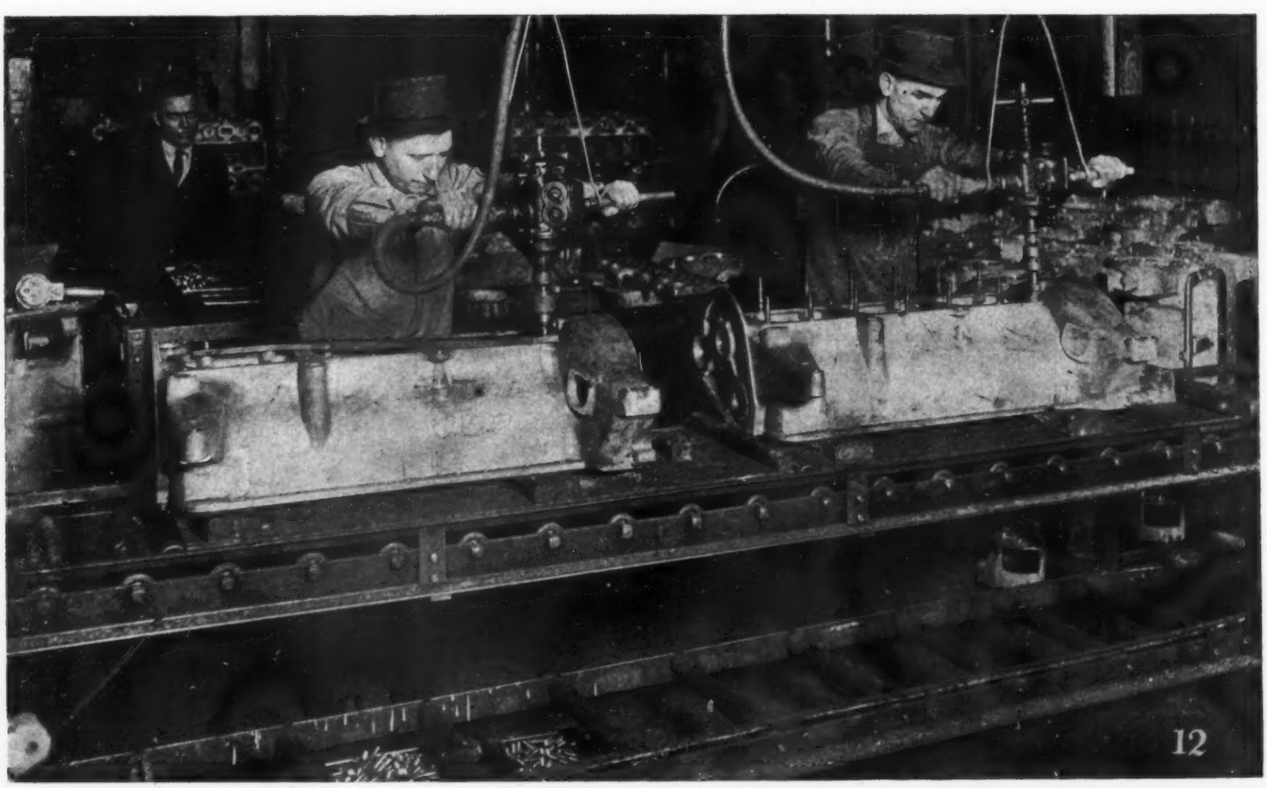


Fig. 12—Putting the studs in the Hudson crankcase after all machining operations are completed. This illustration shows the roller conveyor very clearly

passed along and assembled, the bearings being put in with screws and inspected for clearance, as shown in Fig. 8, by means of a feeler gage which must be able to be inserted between the case and the bearing. The bearings are then rough reamed, as shown in Fig. 9, by pneumatic machines which lower from the ceiling. The front end of the case is then milled and turned over so the generator shaft boss and the water pump mounting can be faced off to line up exactly. Two interesting inspections on the case follow this, first for the proper size hole for both the camshaft and crankshaft bores, which is done by a plug gage method, as shown in Fig. 10, and then a test for gear centers by means of special gages which are mounted in the gear bores and which must align themselves so closely that it is not possible to pass a feeler gage between them, Fig. 11.

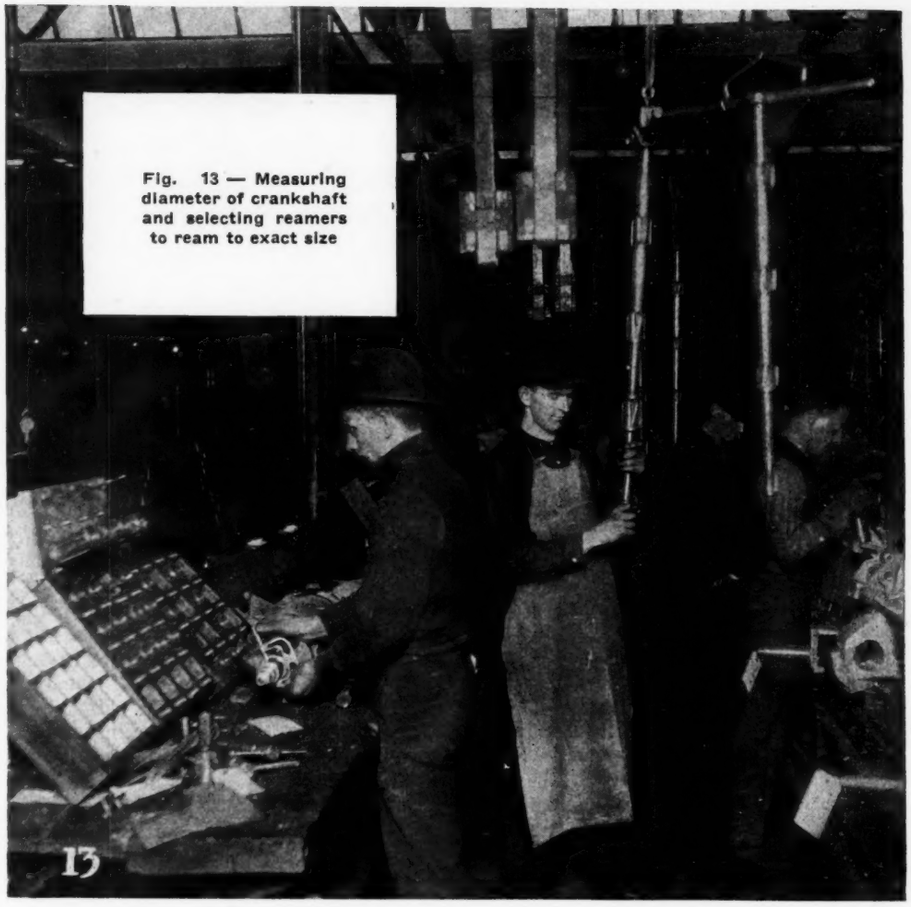


Fig. 13 — Measuring diameter of crankshaft and selecting reamers to ream to exact size

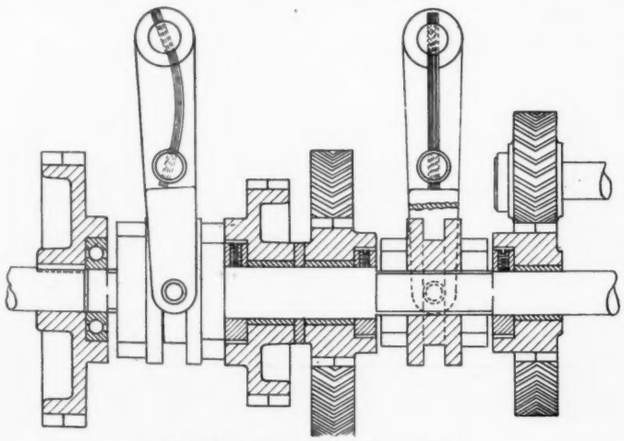
Reamer Selection for Bearings

After these inspections the cases then go along on a roller carrier to the pneumatic instruments which put the studs in place. This roller carrier, together with pneumatic machinery, is shown in Fig. 12. The crankcases are now ready to have the bearings sized, and this is done by an ingenious method which can be appreciated clearly from Fig. 13. In this, the man on the left is measuring the diameter of one of the crankshaft bearings. As soon as he measures this diameter, which must check within a certain limit, he picks out the proper reamer to go into the bearing carrying that particular part of the crankshaft. This reamer is selected and placed upon the reamer shaft which hangs overhead, as shown in the illustration. On the four-bearing shaft there are four reamers, each of the proper size to go with the particular shaft. As the crankcase comes along on the roller carrier, as shown to the right, the reamers are all in readiness so that each set of bearings can be reamed to the proper diameter for the crankshaft they are to carry. The crankshaft is then put in and packing is put in the end bearings of the case, and an inspection of the entire crankcase is made before it is ready to go along to the final assembly.

All the hand fitting on the crankcase is carried out on service plates. The bearing clearances are 0.0015 in. on the rear and 0.001 in. on the center and front. On the camshaft bearings the clearances are 0.0005 in. on the rear and 0.001 on the other three bearings. The limits on the bearing sizes are, plus 0.0005 in. and minus zero.

Glance again at the map of the Hudson engine manufacture and you will find that while the crankcase is going through its stages of development, the cylinders are undergoing their own course of manufacture in a line parallel with that of the crankcase manufacture. This will be dealt with fully next week.

(To Be Continued)



Anderson constant-mesh gearset

Anderson Constant-Mesh Gearset

THERE have been a good many suggestions for gearsets with helical gears always in mesh and clutches for picking up the set required. A patent has recently been granted to J. G. Anderson of Seattle, for such a gearset embodying a special kind of shifter.

As shown in the diagram, movement of the gear lever is transferred to the shifter fork via a short leaf spring. Thus, the first movement of the hand lever will compress the spring and this will shoot the clutch into engagement immediately the two parts of the clutch are in the correct relative positions.

Continental Engines

Six Models Listed for 1917-1918—Three Fours, Three Sixes—From 192 Cu. in. to 349 Cu. in. Displacement—Changes More in Nature of Minor Refinements Than Radical Alterations—Balance Improved

MANUFACTURERS, casting about for engine equipment for their 1918 cars, will find in the line of the Continental Motor Corp. six up-to-date power plants. These are all refined continuations of the models which were on the market a year ago. They are so designed as to cover the entire field from the four-cylinder truck up to the high-powered, six-cylinder passenger car.

These six engines are the result of more than 13 years of specialization in this particular field and show the result of the development through that time. As a result, it is naturally to be expected that the changes are few, and those which have been made are more in the nature of minor details than alterations in fundamental practices.

Better Balance

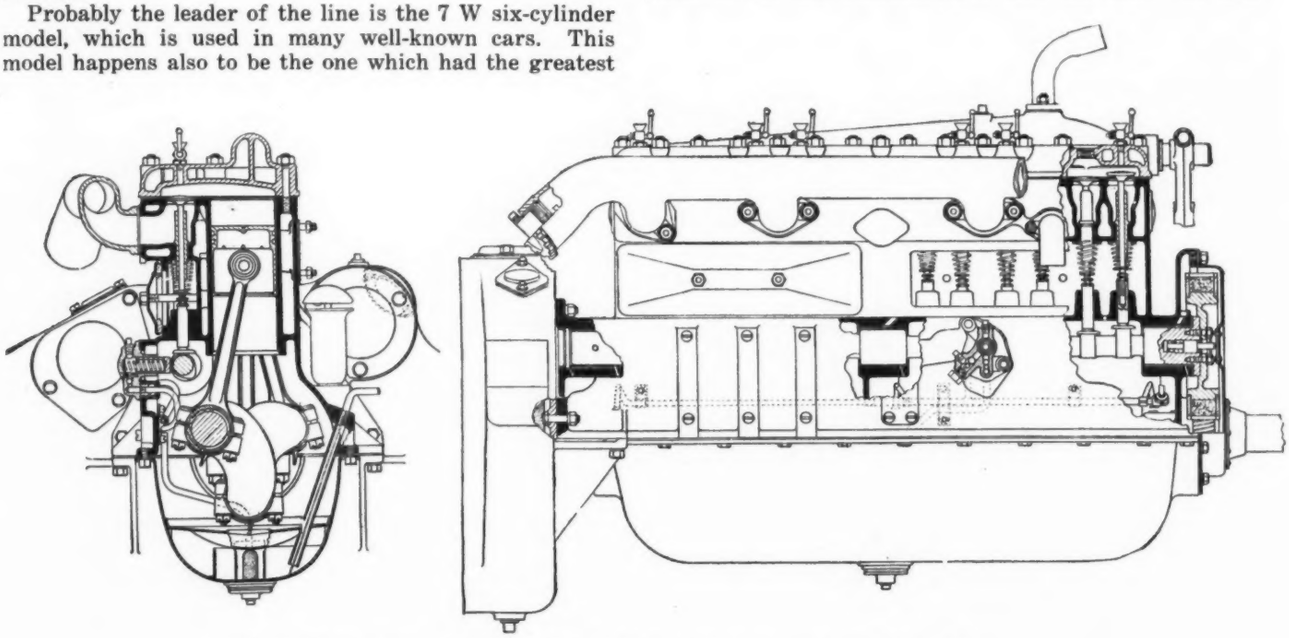
There are certain alterations in practice which are noticeable throughout the entire Continental line. The crankshafts are now put in running balance on a special machine designed by the Continental company and upon which patents are pending. The crankshafts are universally stiffer, due to either increased diameter of shaft or increased crank cheek thickness, and in manufacture the cylinders are now finish-ground instead of lapped. Increased rigidity of crankshaft, crankcase, and connecting-rods probably stands out as the leading change in Continental practice, taken as a whole. Closer and more accurate grinding is also probably another improvement, although naturally this has always been improved as far as machine shop practice of a commercial nature has allowed.

Probably the leader of the line is the 7 W six-cylinder model, which is used in many well-known cars. This model happens also to be the one which had the greatest amount of change. The main change has been in the increased rigidity of the crankshaft, due to the use of stiffer crank cheeks. The shaft itself is of the same diameter but the bending moment has been increased 50 per cent, due to improved heat-treating and the heavier cheeks. An indication of the improvement of this shaft is also shown in the higher scleroscope reading, which is now 45, whereas it was formerly 28 to 30.

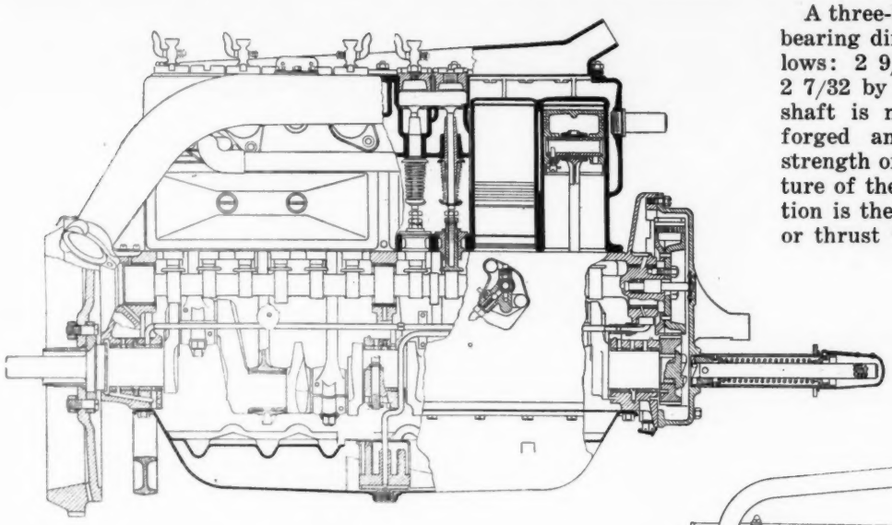
The engine has also been given increased volumetric efficiency by rearranging the valve action and increasing the lift. The lift was ¼ in. and it is now 9/32 in. An improvement has been made in the pistons, which now have three rings instead of two. The rings are 3/16 in. in the present design, whereas they were ¼ in. Another improvement is in the oil pump, which, through a rearrangement of the check valves, has now been made to have better priming qualities. The water inlet is now in the longitudinal center of the cylinders, whereas it was at one end, and another improvement in the water system is that the cooling liquid is carried higher around the valve stem than formerly. There is a better oil indicator on the new engine, having a direct reading showing the degree to which the crankcase is filled with oil in actual figures.

Model 7 W Six Is 3¼ by 4½

The 7 W cylinder dimensions of 3¼ by 4½ in. or 83 by 140 m.m. were designed to meet a demand on the part of automobile builders for a medium powered six which would be capable of withstanding hard service and at the same time be an economical engine, both from the standpoint of the car manufacturer and the user. In this

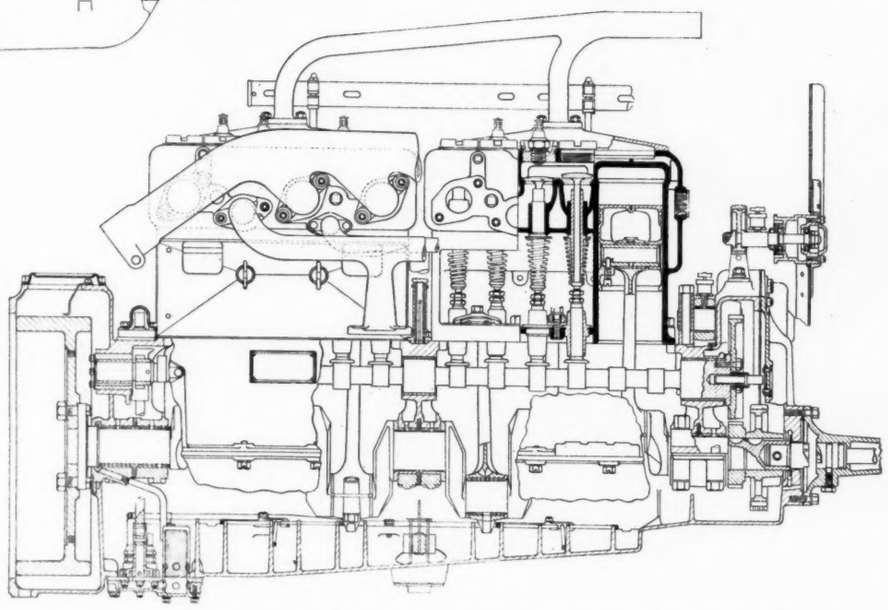


Continental 7 W, six-cylinder engine 3¼ by 4½ in., one of the most popular models



A three-bearing crankshaft is used, with the bearing dimensions from front to rear as follows: 2 9/32 by 2½ in., 2¼ by 2⅞ in. and 2 7/32 by 2½ in. diameter and length. The shaft is made from crankshaft steel, drop-forged and heat-treated, giving a tensile strength of over 100,000 lb. per sq. in. A feature of the shaft which has been given attention is the matter of taking the clutch thrust or thrust in the other direction by means of

Left—Continental 7 N, 3½ by 5¼ in.; below—Continental 3¾ by 5¼, both sixes



engine the six cylinders and the upper half of the crankcase are cast together from a special formula of reverberatory air furnace iron. In handling the castings they are first rough bored to eliminate the exterior casting stresses and then set aside to age to eliminate possibility of distortion. The cylinder head is cast separately and the lower half of the crankcase is pressed steel. It is claimed that with the pressed steel pan several pounds of weight is saved over a cast aluminum case. The engine thus is made up of two iron castings and a pressed steel pan as far as the exterior is concerned. Both the cylinders and the cylinder-heads are water tested after machining, for the purpose of detecting casting flaws, and then the castings are finish-bored and ground to a mirror finish.

The same grade of air furnace iron as is used in the cylinders is also used in the pistons. The pistons are 3½ in. long and carry a piston pin bearing ⅞ in. in diameter and 1½ in. in length. In fitting the rings to the piston grooves and cylinders, a close fit is made with the rings ground on both face and sides. The rings are of the concentric expansion type, and all the engines are run under separate power to fit the rings to the cylinder before they are put on final test. Oil grooves are also turned on the exterior of the piston.

Piston Pins of Steel Tube

For the piston pin, No. 3 annealed steel tubing is used. This is also hardened and ground and is held stationary in the bosses by a locking device. The bearing is carried in the upper end of the connecting-rod and is in the form of a large bronze bushing of dimensions as given. To lubricate this bushing there is an opening in the upper end of the connecting-rod which catches oil from the splash system.

I-beam rods, 8½ in. in length, with the lower bearing 1⅞ in. in diameter and 2 in. long, are used. They are made from .35 carbon steel, drop-forged and heat-treated. The rods are bored and reamed on special jigs, assuring alignment in manufacture, and the connecting-rod caps are fastened in place by nickel steel bolts which are locked.

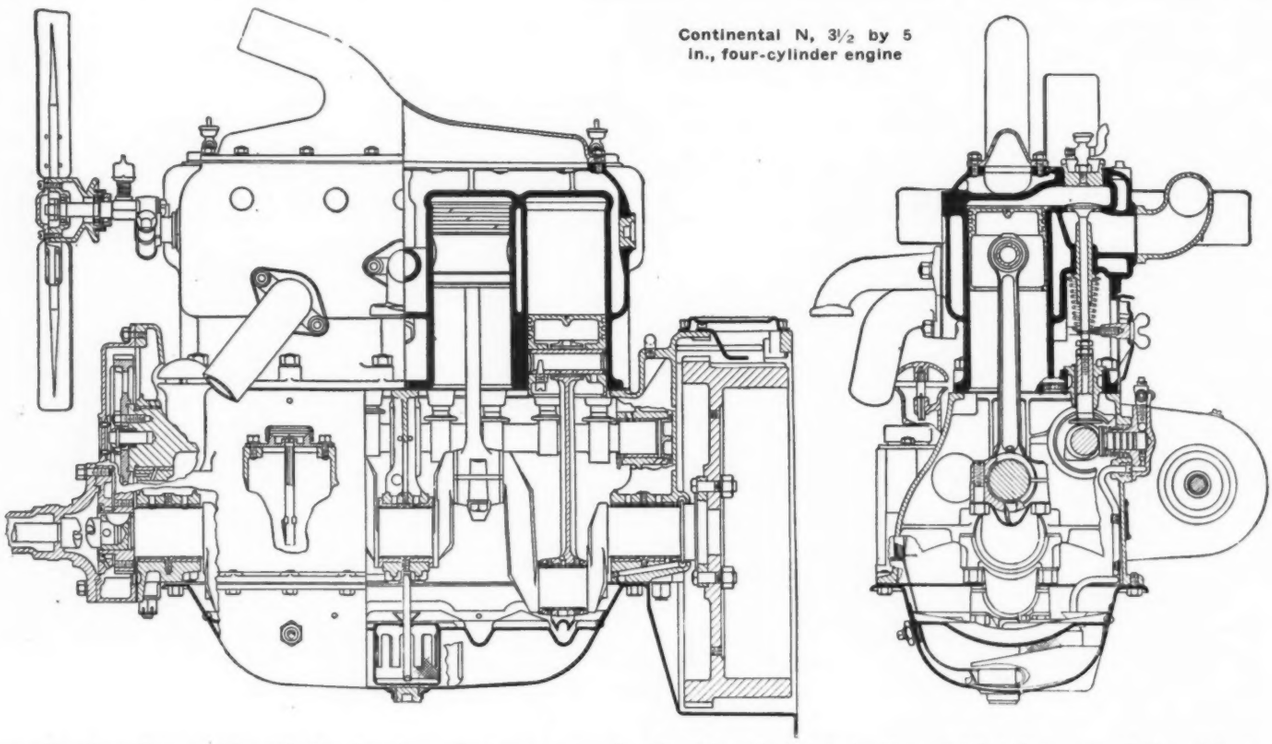
flanges which are provided on both ends of the front bearing.

All the bearings for the crankshaft, camshaft and connecting-rods are of nickel babbitt. The camshaft and crankshaft are backed with bronze which, being a good conducting agent, helps in keeping the bearing cooled. All the bearings, after fitting, are expanded on special expanding arbors and finished with a slow running spiral-cut power burnisher, which is claimed to give an effective bearing area of over 98 per cent of the total projected area of the bearing. For the connecting-rod bearing adjustment punched sheet steel shims are used.

Helical steel gears which are cut on hobbing machines are used. There are three gears to the timing set, composed of a crankshaft, camshaft, and pump shaft gear. These are housed in the case on the front of the engine. The camshaft is drop-forged from low carbon steel and runs in long bronze-backed babbitt bearings. The actual dimensions from front to rear are as follows: 1⅞ by 2½ in., 1 13/16 by 2⅜ in., and 1 11/16 by 2½ in. The nominal diameter of the shaft is 1 in. The camshaft, being rough machined and annealed, is heat-treated, hardening it throughout. It is then finish-ground to accurate size on a camshaft grinding machine and brought to a tolerance limit of within 0.0005. The camshaft may be withdrawn from the crankcase by simply removing the gearcase cover.

The mushroom type of push rods are used. They are

Continental Specifications	No. of Cylinders	Piston Displacement Cu. In.	Bore and Stroke in In.	Cylinders Cast	Valves Placed	Valve Diameter in In.	Exhaust Valve Lift	Piston Length in In.	No. of Piston Rings	Weight of Piston in Oz.	Weight Connecting-Rod in Oz.	Length of Connecting-Rod in In.	Width Wristpin Bearing in In.
Model 7-W	6	224.00	3½x4½	block	right	1 9/16	9/32	3	3	30	25	8½	1½
Model 7-N	6	303.10	3½x5½	block	right	1 11/16	20/59	3¼	3	.....	50	10¼	2 7/16
Model 6-P	6	347.90	3½x5½	threes	right	.....	.....	.....	3	.....	.....	.....	.....
Model N	4	192.40	3½x5	block	right	1 47/64	10/27	3¼	3	.....	50	10½	1½
Model C-4	4	280.60	4¼x5½	block	left	2	15/49	5½	3	.....	.....	11	1¾
Model E-4	4	349.90	4¼x5½	pairs	left	1 31/32	18/49	5½	3	.....	.....	12	.....



Continental N, 3½ by 5 in., four-cylinder engine

made of carbon steel with the heads and stems ground to size. They bear directly on the cams and in turn directly operate the inclosed valves. The inlet and exhaust valves are interchangeable and have nickel steel heads electrically welded to carbon steel stems. The ends of the valve stems are hardened to take the wear resulting from the action of the tappets. The valve stem locking device is a patented design and the entire mechanism is exposed by the removal of the metal side plates which cover the valve action, keeping them free from dirt and tending to quiet the valve action.

Exhaust on Valve Side

In the arrangement of the manifolds the exhaust is carried on the valve side and is separately cast and clamped to the cylinder. Copper asbestos gaskets are placed between the connections of the manifold to the cylinder. A feature also which will be noted in the illustrations is that the exhaust manifold does not interfere with the adjustment of the valves, valve springs, etc.

The cooling is by centrifugal pump fitted directly to the motor as standard equipment. It is provided with two bearings fitted with stuffing boxes and equipped with a drain cock so that the water can be drawn off during freezing weather. Oiling is by combination splash and pressure system. The oil is circulated by an improved plunger pump driven by an eccentric from the camshaft. This forces oil directly through copper tubes to the timing gears and main bearings. From these points it drains back into the oil pan, maintaining a proper level for the splash lubrication which takes care of the pistons, connecting-rods and valve push rods.

In connection with the 7 W engine, either a cone or a multiple disk clutch may be used, and several of the larger gear companies are manufacturing clutch and gearset units especially designed for this type of power-plant. This, of course, refers to the torque transmitted, as the connections are standard. The flywheel housing is removable and can be used either as an independent engine with amidship or rear axle gearbox, or can be used as part of a unit power-plant in which the dimensions of the flywheel housing are governed by the S. A. E. standards.

The fittings which are given as stock equipment on the Continental engines unless otherwise specified by the manufacturer, inlude water connections, adjustable fan bracket, a ball-bearing fan, a fan pulley adapted for ¾ in. flat belt, and a port plug wrench. The flywheel and rear crankshaft extensions are machined to meet the specifications of the manufacturer.

Ignition equipment is not included as stock. The Continental company, however, will, at a slightly extra charge, mount, time and test magnetos which are shipped to them by car assemblers who buy their product. The standard battery equipment sets, of course, can be mounted on standard fittings.

Model 7 N, Six-cylinder Engine

The same standards of manufacture as were mentioned for the 7 W are followed in the 7 N, which is a larger six.

Diameter Wristpin Bearing in In.	Width Connecting-Rod Lower End Bearing in In.	Diameter Connecting-Rod Lower End Bearing in In.	Diameter Crankshaft	No. Crankshaft Bearings	LENGTH OF CRANKSHAFT BEARINGS				Intake	Water Circulation	Motor Lubrication	Materials of Crankcase	Material Cylinders	Material Piston
					Front	1st Inter.	2nd Inter.	Rear						
1	2	1¾	1¾	3	2 14/25	3	.....	3⅝	int-pas	cent	sp-pres	iron	iron	iron
1⅛	2⅛	2¼	2¼	3	2¼	2½	.....	3⅞	int-pas	cent	sp-pres	alum	iron	iron
.....	.....	.....	.....	.....	.....	.....	.....	.....	int-pas	cent	sp-pres	alum	iron	iron
1⅛	2⅛	1¾	1¾	3	3¼	2¼	.....	3⅞	int-pas	cent*	sp-pres	alum	iron	iron
1 3/37	2 10/37	2	2	3	2¼	3	.....	4⅛	int-pas	cent*	circ-spl	alum	iron	iron
1¼	3	2¼	2¼	3	3⅛	3¼	.....	4⅛	int-pas	.....	circ-spl	alum	iron	iron

This has a bore and stroke of 3½ by 5¼ in. and differs from the 7 W design in that it has the cylinders cast in block, with the crankcase a separate aluminum casting. It is also a solid head unit, whereas the 7 W has a separate head. The water jacket heads on the 7 N are cast separately and are retained by screws, a construction which greatly improves the accuracy of the core work in the cylinders and insures better castings owing to the increased ease of obtaining uniformity. No change has been made on the 7 N engine as compared with a year ago, except that the S. A. E. standard bell housing is now given as an option. The same data regarding the manufacturing processes on the cast iron work apply to the 7 N as well as to the 7 W and to the other Continental engines. Pistons are of the same iron as the cylinders and this same casting material is used also throughout the Continental line. The pistons have three rings of the concentric type.

Practically the only differences in construction in this engine as compared with the 7 W are those necessitated by the use of a separate aluminum crankcase and by the fact that the parts must be larger to take the greater stresses, due to the increased displacement. The bearings are all carried in the crankcase.

While the S. A. E. rating of the engine is 29.4 on block test, this engine will develop 50 hp. at approximately 1900 r.p.m. The pistons are 3¾ in. in length, with a piston pin bearing size of 13/32 by 1½ in. The piston rings are 3/16 in. in width. This is a higher engine than the 7 W, having a connecting-rod length of 10¼ in. The lower rod bearing is 2 by 2 3/16 in., and the crankshaft bearings from front to rear are 2 3/16 by 2 23/32, 2 7/32 by 2⅜ in., and 2¼ by 4 in.

Helical-cut timing gears are used. The valve diameters are 1 11/16 in., with a stem diameter of 3/8 in.

As regards lubrication, the same system is used on this engine as on the 7 W, oil being fed by a plunger pump driven by a camshaft eccentric direct to the timing gears and the main and camshaft bearings. The oil drainage then flows into the crankcase splash pans. The same fittings and the same equipment is given with the 7 N as with the 7 W.

Model 6 P Engine

The Continental 6 P is a still larger six, having a bore and stroke of 3¾ by 5¼ in. This gives an S. A. E. rating of 33.5 hp., and the power developed is 48 at approximately 1500 r.p.m. In general design and specifications, this engine corresponds to the others.

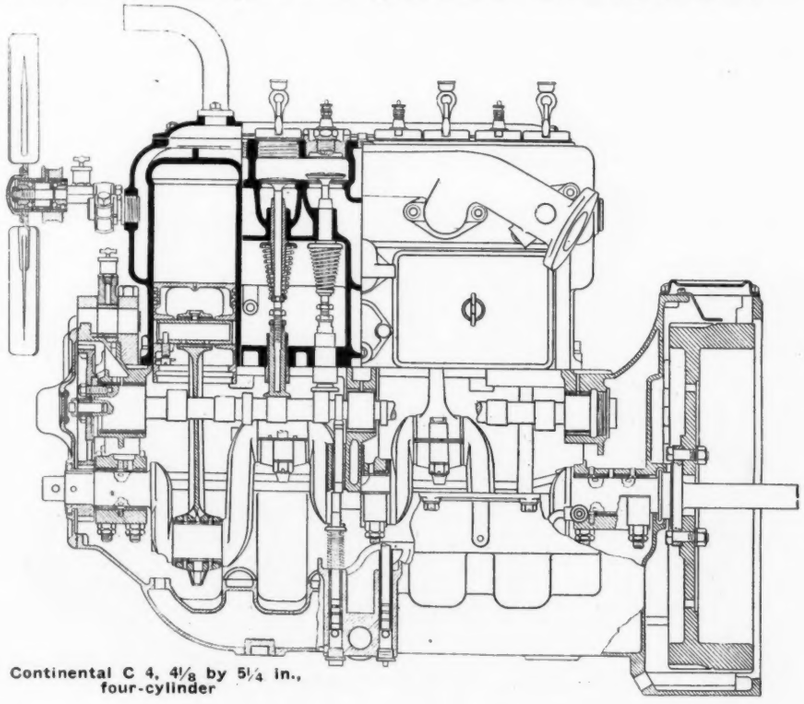
Four-cylinder Engines

Three four-cylinder Continental engines are made to take care of the range of requirements in this class of motor. These are known as Model N, C, and E. Model N is the smallest; C is the medium size, and E is for larger installations. The C type engine is now known as Model C 4, superseding the model C and incorporating several changes, having increased the general rigidity. The crankshaft is now 1⅞ in., whereas it was 1¾ in. This has caused a corresponding enlargement of the bearing diameters in which the increase has been about ½ in. in diameter in all three bearings. The crank pin diameter has also been increased and the I-section of the connecting-rod also.

Model C 4 is particularly adapted to truck use. It is made in two bores—3¾ or 4 1/8 in.—with the same stroke of 5½ in. This gives two piston displacements; one of 232 cu. in. and one of 281. It is designed particularly to handle heavy loads continuously and hence is made up of parts capable of withstanding continued stresses.

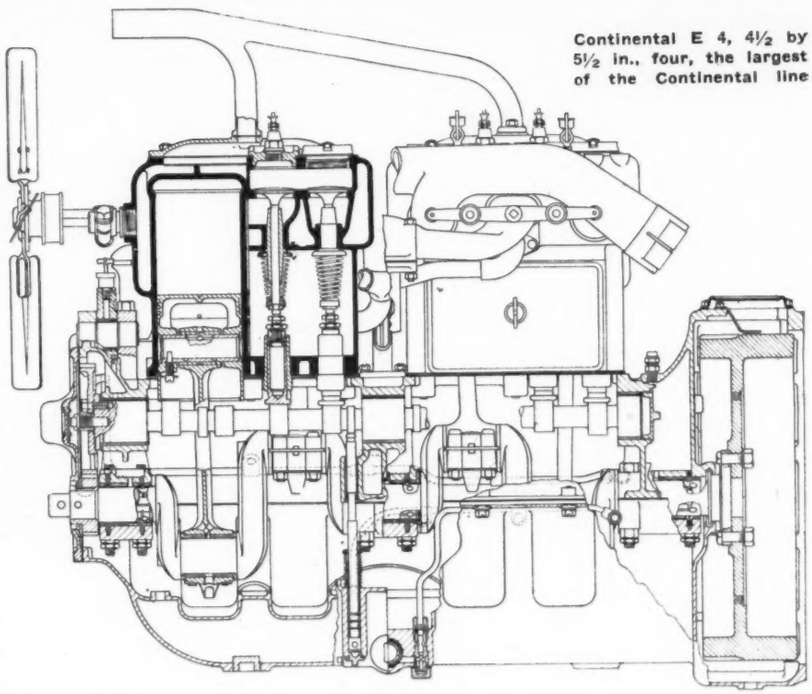
The practice in the manufacture of the four-cylinder engines follows very closely that described in the manufacture of the six; in fact, the cylinder work is exactly the same, with the same grade of air furnace iron used in the castings. There is a difference, however, in the crankcase and oil pan, which are separate, as in this instance both are aluminum castings. All the bearings are carried in the upper crankcase casting and are accessible by removing the oil pan.

The materials for the parts are the same as for the other models. In general design the description of the C type engines follows that of the others exactly, with the exception of the specifications which are given in the



Continental C 4, 4⅛ by 5¼ in., four-cylinder

table on pages 562-3. On this type of engine different mountings are furnished with either three- or four-point suspension, and it can also be adopted to main frame or subframe connection. The standard engines can be supplied in either 17¾ in. subframe mounting or 26¾ in. main frame mounting. The Model C 4 is furnished with water pump. Cooling can be supplied with thermo-syphon water system if desired.



Continental E 4, 4½ by 5½ in., four, the largest of the Continental line

Model N 4 Engine

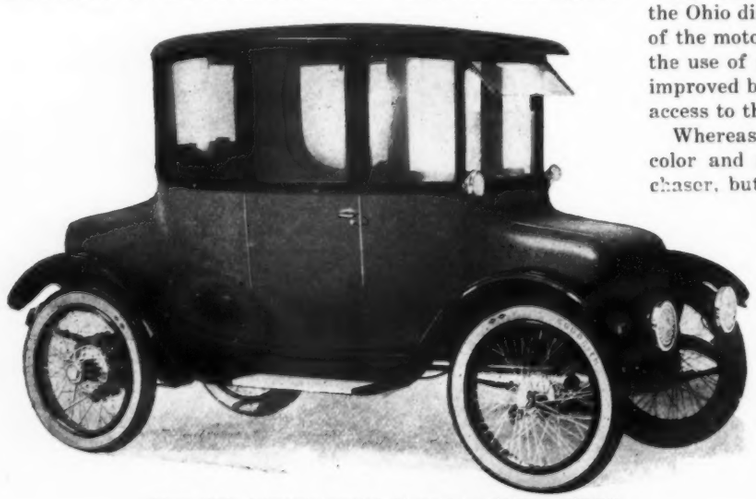
In the Model N 4 four-cylinder engine, which is the smallest engine made by the Continental company as stock, the dimensions are either 3½ in. or 3¾ in. bore, with 5 in. stroke. This is a moderately light engine but is also capable of withstanding continuous service. It is designed as a compromise between the higher speed type and the more heavy type of commercial four-cylinder engine. It reaches its highest efficiency at about 2000 r.p.m. This engine has block-cast cylinders with the crankcase separately as an aluminum casting and a pressed steel oil pan. The materials and general plan of construction are the same as for the other Continental engines with thermo-syphon cooling being used instead of pump. A centrifugal water pump can be attached, however, if desired, at additional cost.

Model E Engine

The largest four-cylinder engine made by the Continental company is Model E. It has a bore and stroke of 4½ by 5½ in. This particular type of engine is used in a great many 3-ton trucks. The cylinders are cast in pairs and are L-head. An increase in the shaft diameter has been made from 1⅞ in. up to 2¼ in. This has also given a corresponding increase in main bearing sizes, these being all 2¼ in. in diameter instead of 1⅞ in. as previously. This engine has a three-bearing shaft, and other than the changes due to the casting of the cylinders in pairs and in the use of cast aluminum for both the crankcase and oil pan, the manufacturing practice is parallel to the other engines mentioned. The S. A. E. rating is 32.4 hp., and the power developed on the block is 45 at 1500 r.p.m. This engine, like the C 4, is regularly furnished in four-point subframe suspension. It is also furnished for main-frame suspension, and, while regularly adapted for independent construction, can also be supplied as a unit power plant. In the unit power plant the engine is only supplied with main frame support arms. Like all the other Continental engines, should three-point suspension be desired it can be supplied.

New Ohio Electric Coupe a Stock Car

THE Ohio Electric Car Co., Toledo, publicly displayed its new model 44 car for the first time at the Boston show last week. This is an attractive coupé model which differs from the models 43 and 66 in that it is a stock car throughout whereas the others are custom built. Model 44 is built on exactly the same chassis as the others, the only difference being in the body. The price is $2,380.



New Ohio Electric model 44 coupe selling at $2,380

The chassis incorporates all the features that have made the Ohio distinctive, foremost among which are the suspension of the motor on semi-elliptic springs on the chassis frame and the use of magnetic control. The control has been somewhat improved by the provision of a removable plate which permits access to the contacts for cleaning, etc.

Whereas the two older models may be finished in almost any color and upholstery combination at the option of the purchaser, but three choices are given with the model 44. The body may be finished in green, gray or blue with upholstery to match. Wheels are either wire or wood at the option of the purchaser and tires may be either 33 by 4½ Goodrich Silvertown cord or Motz cushion.

Choice of Batteries

There is a further option in the speed capabilities of the car. It may be fitted with batteries which will give a maximum speed of 28 m.p.h., or batteries which will give a maximum of 20 m.p.h. Standard equipment is forty cells of 15-plate Philadelphia.

MANUFACTURERS' MERCHANDISING

Manufacturer to Distributor Dealer, Buyer

Sixth Article of The Automobile's New Department

Good Service Costs Far Less Than None

Poor Service a Deadly Boomerang—If Your Car Can't Stay Sold You Can't Stay in Business

A FAMOUS firm appointed a dealer in a big Eastern city who rightly enough was in business to sell cars and make money over them.

The famous firm made the same man responsible for service, and all complaints reaching the factory from that territory were referred to the dealer.

The dealer couldn't or wouldn't handle them.

The result is shown in a letter recently addressed to the editor of THE AUTOMOBILE, which reads substantially as follows:

> *In accordance with your advice, I have taken up the matter of my car with the gentleman whose name you gave me (manager of the service department at the factory), and he has referred me to the local agency for relief.*
>
> *This is the attitude taken by these parties during the correspondence of the past month.*
>
> *I am bitterly disappointed both with the performance of the car and with the attitude of the manufacturers. The principal value of the car seems to me to lie in its very clever advertising rather than in the car itself.*
>
> *The car has run less than 4000 miles under the best conditions as to care and operation, yet I am now confronted with a repair bill for several hundred dollars.*
>
> *I have decided to sell the car and buy one of another make.*

Making the Buyer an Enemy

The writer of this letter bought his car, believing what the advertising and the dealer told him about it. He found that his particular car gave trouble. He then found that he could get no real help from factory or dealer to cure that trouble. Both seemed merely anxious to get rid of him. He felt he had been a "sucker."

What is the result?

The man who, rightly or wrongly, thinks he has been badly treated, thinks the famous firm and their representative dishonest. He sells the car. Yes, but that is not by any means the end of it. For years he is an active enemy of that car. He will never lose a chance of warning off anyone who speaks of that car in his presence. *That one man will almost certainly prevent at least ten or a dozen sales during* 1917 while he is feeling sore and telling his friends about it; perhaps he may prevent many more.

Now the car in question is a pretty good car for its price. It is a low-priced job, but it can and does give great satisfaction to thousands of users. There is some special fault with this man's particular car.

Perhaps the owner is not handling it right, but even so it would be commonsense business to find out why and tactfully show the mistake. Perhaps the car has some really defective part. Then the cost of changing it would not be in any way comparable with the cost of the business that is going to be lost because of that man with a grievance.

There is no firm so strong that it can afford to make knockers of its customers by neglecting their complaints. Allow, if you like, that a majority of complaints are unjustified, still they are complaints just the same.

The Customer Is Always Right

Every man in the world with a complaint against you is damaging to your future business. In salesmanship there is no more quoted phrase than Marshall Field's statement "The customer is always right." If a man brings in a grievance and is handled so that he goes away feeling he has been well treated the cost of putting him that way may be charged to advertising. If he gets no satisfaction, then $100 or $1,000, as the case may be, of your advertising appropriation has been dropped in the sea; is gone, dead, nullified forever.

It costs far less to give service than not to give it.

—

Retreads in Sectional Molds

HERE is a method that will give very satisfactory results:

Cure each section one-half the regular time. After completing this operation again place the tire in the mold, lapping just half-way between the points made on the first round, and cure for the remainder of the period. In this way no portion of the tread will be overcured.—D. R. Cain, Instructor, Goodyear School of Tire Repairing.

Hydraulic Transmission

An Analysis of the Progress Made by This Type of Transmission as Indicating Its Importance to the Automobile Industry in the Future

By F. Leigh Martineau*

IN replying to the discussion after his admirable paper on Worm Gears, read before this Institution on Feb. 12, 1913, Mr. Lanchester made an observation to the effect that when hydraulic transmission could realize overall efficiencies as high as 95 per cent it would have a chance of displacing other forms of gear.

The author in this paper proposes to put forward the position in which this form of transmission stands to-day, and the progress which may be expected from it in the future, so far as can be seen at the present time.

Hydraulic transmission is used extensively at the moment with absolute success for many purposes, but it is not proposed in this paper to consider it from any point of view except as applied to automobiles.

As transmissions of this class are usually applied in ordinary manufacturing work, it has in the past been the rule to use water as the working medium, and it is from this fact that the name has arisen. For uses such as the automobile transmission gear, lubricating oil takes the place of water as the transmitting medium.

The use of oil for this purpose serves several ends:

Lubrication can be arranged for automatically by using part of the medium for this purpose.

Corrosion and erosion are eliminated.

Frost need not be feared.

Packing glands can be eliminated and the mechanical efficiency increased thereby.

The system generally employed in factories and elsewhere has usually been a constant pressure system, which involves large losses at light loads, and such a system is obviously impossible for the work to be considered in this paper.

An apt comparison can be drawn between an hydraulic transmission and an electric transmission, as the two are similar in many respects. In an electric transmission the essential elements are:

1. The prime mover driving—
2. A generator.
3. A conductor system.
4. An electric motor operating—
5. The driving wheels.

So in a hydraulic transmission these elements become:

1. The prime mover driving—
2. A pump.
3. A pipe system.
4. A hydraulic motor operating—
5. The driving wheels.

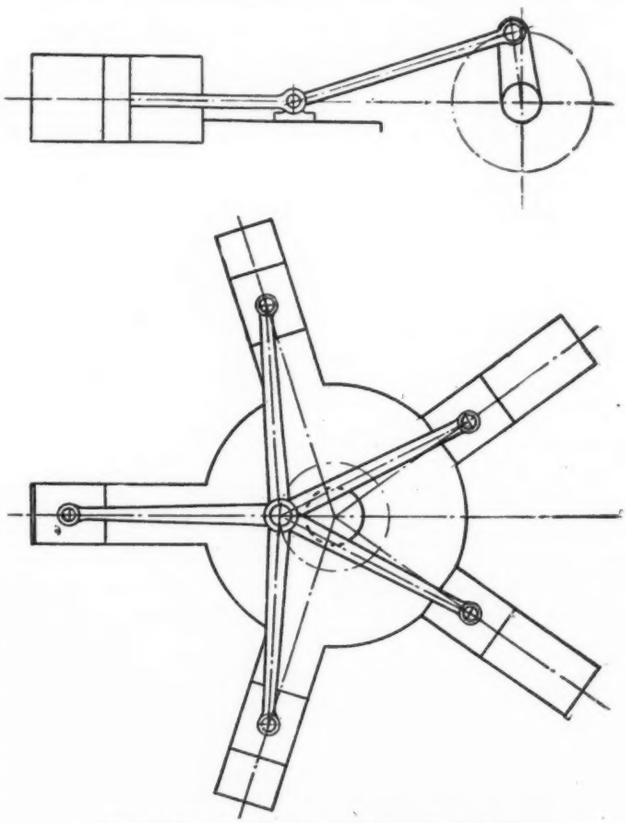
Their operations may be compared as follows: In the former, the prime mover drives the generator and converts its energy into "electric energy," which is conveyed by the conductor system to the electric motor, where it is reconverted for use at the driving wheels. In the latter case, the prime mover drives the pump and converts its energy into "pressure energy," which is conveyed by the pipe system to the motor, where it is reconverted for use at the road wheels.

In like manner the losses may be compared; we have in both cases:

1. Mechanical losses of pump or generator.
2. Energy conversion losses.
3. Transmission losses.
4. Reconversion losses.
5. Mechanical losses in the motor.

Dealing with the hydraulic transmission in more detail, as it is necessary to change the speed ratio between the pump and motor, it is necessary to change the volume of either the pump or motor or of both.

Experience has shown that it is simplest to change the volume of the pump alone, and the results so produced are, generally speaking, good, although there are conditions when it would be useful to be able to change the volume of the motor; it is doubtful if the extra complications involved are warranted by the small gain in results obtained. It may be



Above—Fig. 1—Type I. Reciprocating plunger
Below—Fig. 2—Type II. Radial reciprocating plunger

*Paper read before the British Institute of Automobile Engineers. Martineau has been well known among the members of the institution for many years. Designer of the British Pilgrim car, he later joined with Dr. Hele Shaw in developing the Hele Shaw-Martineau hydraulic-electric steering gear for ships. He also did much work on automobile hydraulic transmissions, and members of the S. A. E. party who visited England in 1911 may remember that a party traveled to one of the factories near London on a truck with this gear.

said, therefore that the basis of an hydraulic transmission is a variable capacity pump.

For this reason it is useful to classify such transmissions by the type of pump employed. There have been at one time or another many different transmission sets built and experimented with; these have given very varying results in practice, but have most of them been abandoned, although some have been run in ordinary commercial service with good results for long periods.

Classification of Transmissions

The classification the author puts forward here is followed generally by all the transmissions of which he has any detail knowledge; there are, however, exceptions, which in some way differ from the general scheme in detail.

Type 1. *Reciprocating Plunger*, Fig. 1—This is really the ordinary commercial crank-driven pump in general arrangement, with the exception that the cranks are made with variable throw. It was proposed for this purpose by Sir E. F. Piers for a gas engine driven street car in the year 1894; later on it was abandoned in favor of a rotary form of pump. Messrs. Clubbe and Southey in 1896 also experimented with this type.

Type 2. *Radial Reciprocating Plunger*, Fig. 2—This may be taken as a Brotherhood engine fitted with a variable throw crank, the crank revolving and the cylinders remaining stationary. The most successful gear of this type is probably the Manly, which has been used to some extent in America, and has often been described in the automobile press both over there and here. An efficiency curve of this type of gear is shown in Fig. 3.

Type 3. *Axial Reciprocating Plungers*, Fig. 4—In this type the cylinders are parallel with the axis of rotation and do not rotate, the pistons and connecting rods are operated by a swash plate which revolves bodily with the shaft. The change of volume discharge is obtained by alteration of the angle this plate makes with the shaft. This type has been worked out by Carl Prött, of Berlin, and an efficiency curve of one of these is given in Fig. 5. The author is not quite clear from the inscription on the sketch in his possession whether this refers to the pump or to a complete set, but he presumes it to be that of the pump alone.

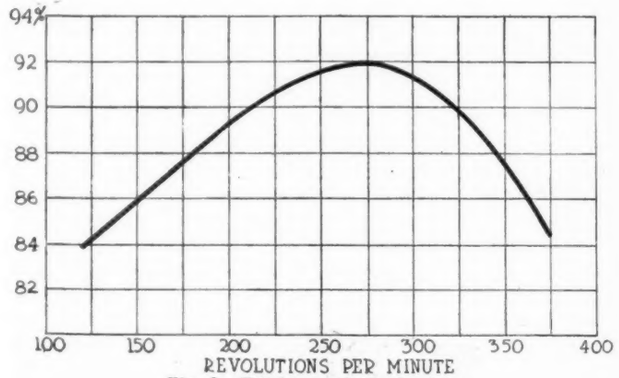


Fig. 3—Efficiency of Manly drive

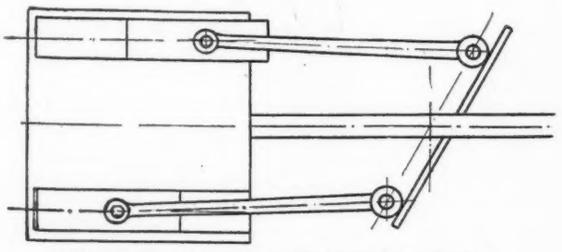


Fig. 4—Type III. Axial reciprocating plungers

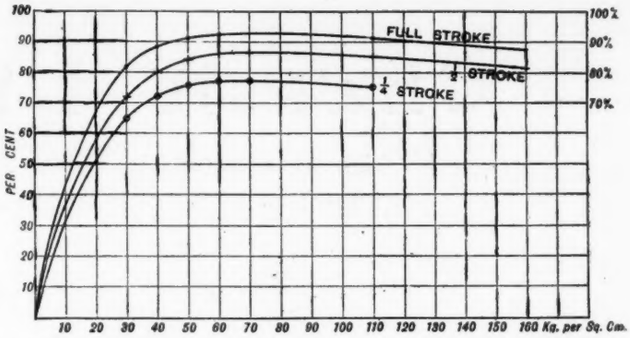
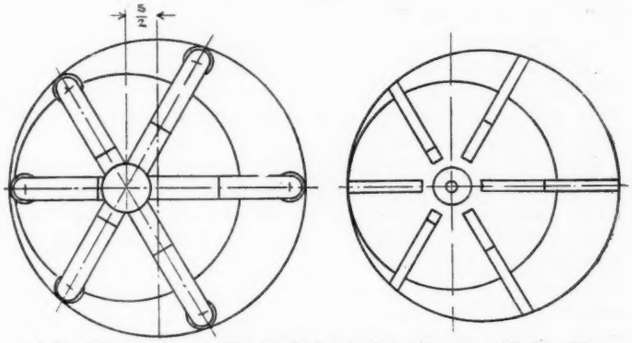


Fig. 5—250 liter Prott system pump. Overall efficiency at 700 r.p.m.



Left—Fig. 6—Type IV. Radial rotating plunger. Right—Fig. 7. Type VI. Radial moving vanes

All the types so far mentioned suffer from the same mechanical difficulty, namely, that the alteration of volume discharged has to be made through a *revolving part* which is transmitting the *whole torque* of the prime mover.

Type 4. *Radial Rotating Plunger*, Fig. 6—In this type, which is the converse of Type 2, both the cylinders and their plungers rotate, the cylinders around a fixed center and the plungers around a center which is capable of being adjusted so as to give variations in the volume swept. The Hall transmission belongs to this type, but the chief exponent of the type is Dr. Hele Shaw, a past president of the institution, and the pump invented by him and on which he has spent so much energy in perfecting is without doubt the simplest of all the types.

Type 5. *Axial Rotating Plungers*—This is the converse of Type 3, Fig. 4, as the cylinders and pistons rotate on a fixed center and the swash plate is stationary, so that its angle with the shaft can be easily adjusted; it is necessary, however, to transmit the whole torque through a universal joint of some form, the position of which has to be absolutely exact. A member of this Institution is responsible for its design, and it is usually called after him, the Janney gear.

Radial Moving Vane Type

Type 6. *Radial Moving Vanes* Fig. 7—In this type a drum with vanes set in grooves formed in it, is revolved in a case and the position of the center of the drum in the case is shifted in order to vary the delivery. In this type the slip past the vanes, at anything but quite low pressures, becomes a very large percentage. It follows that the pressure used must be kept low and the volume pumped large; this means that the hydraulic losses with a pump of this type are large, and the efficiency low. A pump of this type has been used for motor car transmission by the firm of Lentz Bros. in Germany, and some of these cars have been tried over here. The author has been informed that the temperature increase in the oil with this type is prohibitive; if this is the case it at once proves the low efficiency.

(To be continued)

Chassis Lubrication

Wear in Bearings—Use of Oil-less and Impregnated Types—Methods of Lubricating—The Ferguson System

By Roland Chilton

EDITOR'S NOTE.—Lubrication of working parts of a car not included in the power plant and transmission are considered in the following paper, to be read before the Detroit section of the S. A. E., March 16.

AT its inception the automobile was regarded quite frankly as a horseless carriage, the horse being replaced by a mechanical prime mover and transmission gear. Engineering attention has naturally been mostly concentrated on these last units, as they represent the radical development involved in the automobile, the vehicular parts of which were already established by the coach-builders, whose traditions they have not wholly yet escaped.

As the weight and running speeds increased, the necessity for inclosing and providing continuous lubrication for the motor and transmission parts has been recognized and acted upon. In the case of the chassis parts, however, this development has been much slower, which is largely due to the fact that, while an automobile with a seizure in the motor or transmission will not operate at all, yet it will and often does run with most of the spring joints and other chassis parts rusted up or worn loose, with the familiar squeaks and rattles, harshness in the suspension, stiffness in the steering, etc., etc. A great deal of the labor necessary to maintain the average automobile in running order is that expended in the endeavor to keep the chassis parts lubricated by way of the conventional grease cups and oil holes. The elimination of the necessity for this very dirty job provides a powerful sales argument, and hence the interest which the subject has aroused.

Causes of Wear

Adequate provision for the lubrication of a bearing is quite useless unless the entrance of dirt and water is prevented. With a liberal supply of road grit in a bearing (the usual condition of most chassis parts at present) its destruction is rather facilitated than otherwise by the presence of a lubricant. Water causes rusting of steel surfaces, which aggravates wear, often causes complete seizure of a plain bearing, and will ultimately entirely destroy a ball bearing. Thus the protection from the bombardment of mud and water to which most chassis parts are subjected is of paramount importance in the case of lubricated bearings.

Another source of wear which no amount of lubrication can prevent is that arising from the impact on a joint due to vibration of the parts which it connects. Brake rods and steering joints suffer greatly in this respect, because the long rods which they support are apt to develop periodic vibrations, which often have the effect of literally pounding away the pins and bushes. To make the joints large enough to stand this punishment usually involves too bulky a job. A more scientific solution is to impose an initial load between the joint surfaces by means of a spring strong enough to prevent the surfaces separating under vibration, and so prevent the development of impact loads. When this is done in a ball bearing steering joint, for example, a small bearing surface will give good service, where a comparatively large surface in the free type of joint will rapidly pound away.

Mal-alignment in bearings is another source of wear outside the province of lubrication. For example: the pin joint at the axle end of a cantilever spring may be pulled several degrees out of alignment when one wheel lifts, and the action of the spring draws that side of the axle forward or back. In such cases, and where a chassis or other deflection can throw the bearings out of line, a self-aligning feature must be utilized or no amount of lubrication will avoid the binding and wear of the parts.

Oil-less and Impregnated Bearings

Metal surfaces subject to continued sliding contact under pressure, and when dry, will abrade, but it appears that this is not the case where the surfaces are of metal bearing on suitably prepared asbestos, wood, graphite, leather, paper, cotton fabric, fiber, celluloid, camel hair, mica, soapstone, jewels, and other non-metallic substances. These materials are being used for bearings in various mechanisms where oil is impermissible or difficult to provide for, and oil-less or impregnated bushings using one of the first three materials are already in commercial use in the automobile industry. For cases where it is essential to have the least possible friction, or where high speeds would generate excessive frictional heat, such bushings are out of the question, but this does not affect their usefulness in most of the bearings of the chassis mechanism of an automobile. Such bushings have already been used with success in spring eyes, for brake shaft bearings, clutch pilot or thimble bearings, clutch draw collars, gearshift shafts, steering shafts, cooling fans, etc. Spring inserts have been developed to meet the special case of sliding contact occurring in laminated springs. Engineers are not agreed as to the amount of friction desirable here, but all concede that this friction should remain constant in amount throughout the life of the spring. The enormous increase in friction which is caused by rust, which develops when the ordinary springs are not kept continuously greased, is a well known cause of the harshness in suspension of many cars.

Possibly the severest case of sliding friction under load which occurs in automobile practice is that of the clutch, and considering the extraordinary durability of the bonded asbestos materials when used against hard steel plates for this very severe duty, the writer expects to see very great developments in the use of asbestos compounds for bushings. There are numerous examples of single plate clutches using this material where the wear after continual service can scarcely be measured, the effects of the sliding being merely to put a glass-like polish on the surface of the hard steel and the asbestos fabric.

Data as to the bearing pressure which can be safely used on the various types of oil-less bushings are not yet very complete, but their application as spring eye bushings working on the standard size pins is already reported to be successful in several directions. Intermittent reciprocating movement often causes difficulties in lubricated bearings, probably because the oil gets squeezed out when the parts are at rest, and the slight subsequent movements are insufficient to draw a film in between the surfaces again. Oil-less bushings do not appear to suffer from this disability, nor are they so susceptible to the effects of dirt as are oiled metallic bearings. The bonded asbestos bushings, being more yielding than the metallic ones, do not have their surfaces pounded away so readily under the shocks due to the vibration, provided they are backed up by suitable containers to prevent the material

spreading. Such bushings also appear to be free from any tendency to set up "squeaks."

The so-called chassis lubrication problem can be further avoided in the case of reciprocating movements by employing a flexible member which will permit the necessary movement without sliding contact. An automobile road spring is an example where such a member is used to guide an axle through several inches of travel, a function for which axle box guides are used in railway rolling stock. An extremely difficult lubrication problem is here avoided in the case of the automobile. Flexible type of universal joint affords a further example. Ball bearings also tend in this direction, as with proper lubricant retainers and adequate capacity in the housing these will run for long periods without attention.

There are thus two main lines along which the problem under discussion may be tackled: either we may work in the direction of automatic lubrication with metallic bearings, or we may develop the various "oil-less" types of construction. In each case the object we have in mind is increased durability of these bearings, and to render them as independent as possible of attention in the way of lubrication, adjustment and replacement.

Various Lubrication Methods

Referring now to the "lubrication" method of obtaining these objects, we find that the first steps in this direction were made by substituting for the conventional grease cup a reservoir of large capacity, and arranging for oil contained in this to be slowly fed to the bearings it is to serve. Steering rod joints may be conveniently treated by this method, the steering tubes being filled with oil and communicating with the surface of the steering ball by way of a hole. In order to minimize the rate at which oil is passed, the joint must be so designed that there is always a pressure between the surfaces at the point where this feed oil is drilled. The sliding of the surfaces as the joint works is relied upon to draw in sufficient oil to maintain a film, while the surging of the oil in the tube insures that the former reaches the joints at either end. One reservoir may of course feed a large number of points, but to cut down the oil consumption it is essential in all cases to drill the feed hole on the loaded side of the bearing, when adequate lubrication during many months of running may be obtained through one filling of the reservoir. Going still further, the necessity for this last operation may be avoided by coupling the parts concerned to the engine lubrication system in such a way that the driver can occasionally pass a small quantity of oil by opening up a valve normally held closed by a spring. This method has already been used to replenish the steering box and to supply oil to the torque rod head and other points. To obtain complete automaticity, together with low oil consumption, the problem to be solved is that of positively delivering very minute quantities of oil to the various parts. One method of doing this is to convey to the rest of the chassis parts the "weepage" from one or more of the principal bearings which are fed directly from the engine lubrication system. If the oil lead in these metering bearings is taken to a point which is always under load, oil will only weep through when the bearing moves, and the quantity can be regulated by adjusting the distance along which the oil has to creep between the bearing surfaces.

The fact that most drivers will not continually fill up grease cups, and the frequent renewals necessary with unprotected metallic bearings has naturally been forcibly impressed upon garage and repair men, and the impulse for improvement has come largely from their camp. The first extensive scheme for overcoming these defects by the lubrication method was the conception of J. B. Ferguson of Belfast, Ireland, with whom the author was associated in the design of a car to embody this feature.

The basis of this system is an oil circulation pipe which runs from the engine oil pump and delivers back freely to the oil pump. This pipe connects to the hollow trunnion pins at the center of the four cantilever springs of the car. This is the only oil line in the entire system, and the oil pressure at the spring fulcrum pins is merely that due to the resistance the line offers to the flow of oil. This pressure is determined by the relative size of the pipe line and of the delivery hole from the pump. It should be noted, however, that in the event of tendency to stoppage in this pipe the full pump pressure is available to clear the obstruction. An oil hole is drilled through the bottom wall of each of these spring fulcrum pins, *i.e.*, at the point where the load on the chassis always exerts a pressure between the bearing bush and the pin. It is the minute quantity of oil which weeps through between the pin and bush under the influence of sliding action that is used to lubricate all the rest of the chassis parts. This oil is led through grooves between the spring leaves to lubricate the bearings at each end of the springs and from there to the other working parts. Thus, from the rear end of the front spring the pedal bearings are oiled. From the front end of the front spring the front axle radius rod joints are supplied. From the front end of the rear spring the brake cross shaft bearings receive their supply, and any surplus oil from the rear end of the rear springs serves the brake cam shaft bearings. All the spring joint housings are provided with lips, around which the ends of leather gaiters which inclose the springs are clipped. The spring joint housings are so designed that the working parts are entirely inclosed when the gaiters are in position.

The front hub has a large grease capacity and is connected with the grease space in the ball bearing steering knuckle, so that one filling serves both parts, which have grease retainers designed to look after the effects of centrifugal force, gravity and capillary attraction. The steering tubes themselves form grease reservoirs; the joints are equipped with spring loaded oil retainers, and are also hung so that gravity tends to keep the oil from being lost; oil is metered on the weepage principle before described. The steering box has a large oil capacity and an efficient oil seal at the point where the shaft emerges, which remarks also apply to the emergency brake hand lever mounting. The gearshift, foot brake and accelerator pedal bearings are all mounted on the power unit from which they receive their oil supply. The pedal bosses are held permanently in contact with flanges on the shaft bushes by the end pressure of a spring, which prevents oil leakage at this point. The brake connections are of stranded cable working on segmental sheaves on the brake levers, a construction which does away with the possibility of rattle and the necessity for oil. The fan is mounted on the overhead camshaft, and the electric generator and self-starter are inclosed under covers on the engine casing. The universal joint at the top of the propeller shaft is inclosed in the torque rod head and is lubricated by pressure. The torque rod head is of hemispherical sandwich construction, which renders it oil tight; it forms the rear cover of the gearbox, from which source it receives its lubricant. The speedometer driving gears are inclosed in a case which receives the splash from the universal joint. It should be remarked that throughout this chassis all oil passages are of large size in order to avoid liability of clogging.

No Grease Cups or Oil Holes

It will be seen that while automatic lubrication has not, owing to the complication involved, been applied to every part on this chassis, yet the large capacity reservoirs provided in the few cases where manual oiling is still used have a sufficient capacity for several months' running. There is no grease cup or oil-can hole on the whole car, while the average chassis has anything from thirty to sixty of these requiring repeated attention. As in other cars, the engine and rear axle must be kept supplied with oil, and should be occasionally flushed out with kerosene. The engine oil filter must be kept clean, and the few oil reservoirs replenished every few months. This constitutes the total attention required in the way of lubrication.

Foreign Trade Department

Exporters Must Know the People—Must Not Crowd Foreign Customer—Courtesy Essential

KNOW the people. That is the only sound basis on which to establish American trade in Australia. The importers of that continent and the Latin republics follow the European tradition. Their ways are not our ways. They are conservative, form the habit of dealing with certain houses, and are loath to change even for financial advantage. The Yankee's striking business policy acts in Melbourne like the bushman's boomerang. The Australian feels the same way about receiving a punch in a letter as he does about getting one in the solar plexus.

Continued stress is being laid by the American consuls on this phase of our business relationships with Australia, because of the fact that conditions are so amicable at present. The automobile maker along with other lines of industry is doing a tremendous business in these British colonies at present. The houses of the United States are establishing a happy range of acquaintance in Australia due to the fact that the war shuts out competitors. But this pleasing state of affairs can last only if the exporter realizes the value of conservative methods in dealing with this market.

Poor Business Letters

Philip B. Kennedy, American commercial attaché at Melbourne reports "The managing director of probably the largest American business in Australia said that more harm had been done in Australia by the 'American sales letter' than by any other one thing. The manager of a large Australian business and a big importer said that he always tore up 'discourteous letters' which he received from the United States."

Although the American manufacturer has been progressive, in correspondence, from our standpoint, and has hence lost business through trying to "crowd" the customer; yet in other departments of the export business where progressive methods would count, he has lagged behind.

Inferior Packing Causes Trouble

Inferior packing of American goods has caused much trouble for the Australian importer. Frequently shipments come from the United States with "insufficiently packed" stamped on the steamship bill of lading. This means that the transportation company waives responsibility for any damages. The importer loses on any spoiled goods unless he can get reparation from the manufacturer. Export commission houses frequently repack American goods before they leave the country, and charge it up to the manufacturer. If there isn't time for this, the commission house may settle at once for any loss from breakage the importer may incur, and take the responsibility of collecting from the producer.

Accessories Likely To Be Stolen

Loss by theft is common. Packing cases which cannot be readily broken open should be used. Exporters in certain circumstances have found it worthwhile to use zinc-lined boxes. Automobile accessories such as spark plugs, carbureters, and other articles readily concealed are likely not to reach their destination unless strongly encased. The method of advertising an article by inscription on the packing box is likely to incite to theft.

Insurance, however, may protect the contracting parties against losses by pilfering. It is well also to insure automobiles and parts against rust. Parts should be packed in lots of not over $487 each as this is the liability limit which the steamship company will assume for any one case.

The freight congestion at the ports of the United States has sometimes led to the importer's bank receiving shipping documents and drafts before the goods have arrived. The bank frequently makes the importer personally liable in such cases, and he then has to pay for the goods before he gets them. The better way is for the exporter not to send the documents until the goods have actually left port. Certification of invoices by the British consul is not required in Australia. But certification may be required of goods apparently of German design that they are not of enemy origin.

Tariff Favors Great Britain

Automobile makers will find that the Australian tariff is rigidly, yet usually fairly, enforced. The regulations apply also to Tasmania, but not to New Zealand. Sometimes the letter of law is stringently enacted. An automobile house, for instance, sent a delivery car to Australia with a canvas-covered top which cost about $50. The duty on covered automobile bodies, intended to apply to limousine bodies, is $204.12. The importer was forced to pay this amount for the canvas top, though he was willing to avoid the duty by throwing the top into the sea.

Great Britain now enjoys a preference of from 5 to 20 per cent ad valorem in the Australian schedules. A revision of the present tax is imminent, and the change will likely not be favorable to American interests. The war, although benefiting America temporarily, has added to the prejudice against the United States in view of our neutrality to date. Conversely the United Kingdom is more of a unit, and more inclined to enact preferential economic legislation.

Although goods may be sold at a lower price abroad and greater discounts allowed, the duties are charged on the basis of price for home consumption. The tax is levied upon the f.o.b. value at port of shipment plus 10 per cent. Wilful attempts to deceive may be punished, but the "rule of reason" is applied in each case.

Methods of Financing

Australian importers who purchase direct from American manufacturers usually arrange for payment through a local bank by letter of credit in favor of a named firm which must turn over shipping documents upon presentation of draft for payment. The seller receives the cash value of the draft, and the costs of financing are usually borne by the importer.

The Australian importer may also purchase through American export commission houses who will handle the buying, shipping, and financing of the commodities. Many importers who do their buying direct find it worthwhile to have a commission house attend to the buying and financing.

The financial situation is so upset at the present time that it is not worthwhile to state the conditions of the money market in detail. It is possible that financial customs will be considerably altered at the close of the war. Tradition and sentiment will lead Australians to carry their large accounts in London; on the other hand the National City Bank of New York is aiming to make New York the financial center. Aus-

tralian accounts are attracted to London by the 4½ per cent rate there, as against the 2 per cent prevalent in New York. The National City Bank conversely offers the service of market experts in all corners of the world in lieu of high interest rates.

Understand Goods Thoroughly

The commercial traveler in Australia need have little difficulty if he starts on his journey equipped. He must understand his line thoroughly. He must avoid agggressive methods. He must be reserved and competent to represent the firm in every capacity. A power of attorney should be given to him, since the 72 days round trip for mail or the high cable tolls make communication with the home office difficult.

The maxim, know the people, again comes into use here. An agent by the name of Hohenzollern, or Busch, would do no business in Australia to-day even though he wrapped himself in the American flag and sang "Rule Britannia." American houses at this time should send out only men who are obviously Anglo-Saxons.

There are no license fees required, but an income tax is charged on business done. The income is estimated to be 5 per cent of the selling price. The rate of taxation is approximately 7¼ per cent of the income.

Printed advertising matter is dutiable at the rate of 20 cents per pound. Merchants will refuse to receive catalogs unless the amount of the tax has been sent on in advance. Heavy catalogs and samples may be conveniently sent to Australia through the American Express Co. or Wells Fargo Express Co. who make arrangements with the local companies there for the duties and delivery.

Care should be taken that the proper amount of postage is provided on correspondence and parcels sent from this country to Australia, as the regulations are different from those applying to most foreign countries.

For the automobile exporter who has not already established business connections with Australia the daily commerce reports of the U. S. Bureau of foreign and domestic commerce, Washington, D. C., will be most useful. These reports are furnished at a nominal rate, and the bureau is in a position to aid the manufacturer in getting in touch with Australian markets.

Gasoline Crisis in Great Britain

ACCORDING to reports, Great Britain is facing a gasoline crisis. The quantity of petroleum reaching English ports in the early part of February was smaller than those to which Great Britain has been accustomed. The total was 7,200,000 gal., but there was not a single consignment of gasoline. New restrictions have been framed by those having the matter in charge, to reduce the consumption of the article for ordinary purposes at home.

Warner Trailers Are Steered Automatically

Front Axle Similar to Truck Design—Automatic Catch on Coupling Bar Is Another Feature

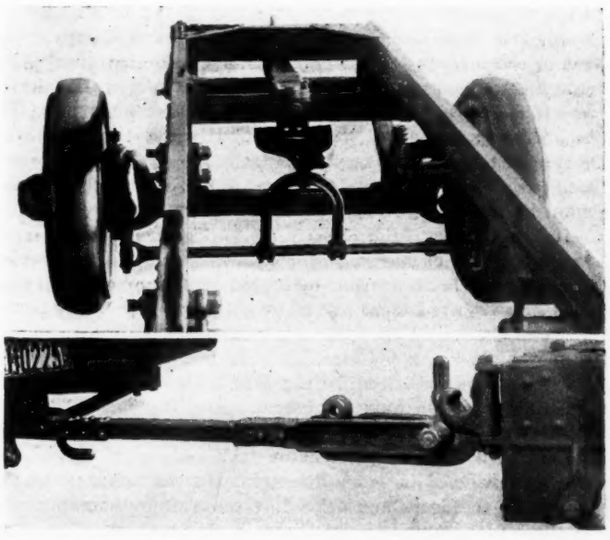
A GOOD many people imagine that a motor truck trailer is any sort of vehicle that can be tied on. Within limits this is true, that is to say, a truck will draw almost anything, but the trailer, if it is to be efficient, if it is to carry its load with a minimum expenditure of power, requires to be a real engineering job.

One of the most important things is that the wheels of the trailer should steer so as to follow the tracks of the truck. In the Warner trailers, made by the Warner Mfg. Co., Beloit, Wis., this automatic steering has been well taken care of. Each trailer axle is similar to a truck front axle, giving the two pairs of wheels independent steering ability. The coupling bar which joins the trailer to the truck swings laterally on a vertical pivot attached to a cross member of the trailer frame immediately above the axle. The two steering knuckles are connected by a conventional tie rod, and to the center of this tie rod a steel horseshoe is secured, this being connected from its center to the coupling bar by means of a universal joint. Thus any lateral movement of the coupling bar is necessarily followed by steering movement of the trailer wheels. The universal joint, it is claimed, is of such a construction that no condition of loading of the trailer can cause any deflection of the steering.

Another Warner feature is an automatic catch on the end of the coupling bar. Assuming the truck and the trailer are an inch or two further apart than they would be when coupled, the bar can be laid on the hitch and then by backing up the truck coupling is made automatically. The detail has been sketched and is shown in the illustration. The pin *A* falls into the slot *B*, the spring trigger *C* holding it in place. At the forward end of the coupling bar there is a gun lever held in place by a spring bolt which can be very easily released. This method of coupling makes it possible for one man to operate the truck with several trailers, hitching and unhitching them without assistance.

The trailers are very stoutly built and are made in a number of sizes ranging in capacity from 2000 to 14,000 lb., and the price from $585 to $1,485.

Automatic catch on Warner trailer coupling bar. Pin A falls into slot B and spring trigger C holds it in place



Above—Truck type front axle which gives Warner trailer automatic steering. Below—Coupling bar in use

India Will Need Trucks

American Manufacturers Already Have a Hold on This Market —Rapid Expansion After War Expected—Service Important

THE Indian Government has recently sprung a great surprise upon the country by prohibiting the import of motors of all descriptions, including commercial vehicles, except those required for Government purposes. For some time past there has been a great influx of American motors into India, and it has been deemed necessary to stop this entirely owing to signs of a shortage of petrol and because of the need for shipping tonnage now occupied in carrying motor cars from the United States.

In Bombay, Calcutta, Delhi and most of the other large cities in India meetings have been held protesting against this new regulation, and it is possible that the representations of the importers may cause the Government to alter the restriction to a certain extent and permit of a few cars and vehicles being brought into the country. In any case, however, there is bound to be a considerable diminution, and no doubt British manufacturers will view this policy with satisfaction.

Obstacles to Use of Trucks

Up to quite recently motor trucks had not been used at all commonly in India. Many reasons have combined to bring about this state of affairs. Labor is extraordinarily cheap and plentiful for all unskilled work (although skilled workmen are scarce enough), while the method of transport universally adopted is extremely cheap. This is by means of bullock-wagons, drawn by two sturdy bullocks, and although slow in the extreme and the cause of fearful congestion at times in streets and docks, the cost is so low as to make it well-nigh hopeless for motor traction to compete from the point of view of low running costs alone. Fuel stands at a high price (35 to 40 cents per gallon), drivers require fairly good wages, and very often the delays so common in the East destroy the advantage of the speed of the motor vehicle.

Great Development Probable

Yet it seems clear that none of these objections is sufficient to prevent a great development in the employment of motor trucks in India. It is becoming more and more apparent to the leading traders and public bodies that the greater carrying capacity, the general convenience and cleanliness, and the higher speed of the motor vehicle more than counterbalance any increased cost, while the advertisement to be derived by delivering materials by motor instead of by bullock-cart has not escaped the eye of the discerning business man, be he native or European.

If the question of motor transport is taken up in earnest in India, there seems to be absolutely no limit to its development. There is an enormous amount of material of every description required to be moved over long and short distances, and one has only to see the continual service of thousands of clumsy bullock-wagons lumbering all over the roads in a big city like Bombay to realize the fact. This method of transport, owing to its huge proportions and the general lack of control, is a public nuisance, and from this point of view alone the introduction of motor transport on a large scale will be welcomed in every direction. In the large ports congestion in the docks and delay in discharging steamers is due to the bullock-wagons, and there is no doubt that every encouragement will be given in official quarters to the use of trucks. In fact, so soon as it is possible to obtain reasonable deliveries there will be many large orders placed by Government departments.

As in other countries, presumably, various types of commercial vehicles will find their uses, but present indications seem to point to the 3-tonner as being the model that will be most generally required. Roads are for the most part bad and very substantial construction is necessary. Light trucks will probably not have much vogue, as coolie labor is so abundant for the carriage of all moderate parcels, even over fairly long distances. Again, however, the question of advertisement and smartness arises, and there is reason to believe that a few of the more important storekeepers and dealers will go in extensively for 1½-ton trucks.

It is scarcely necessary to remark that those British manufacturers who intend to enter the Indian market on a big scale—and this is the only way it should be entered—must pay as much attention to the running of their motors after they are sold as to their selling. Every facility for the rapid repair and replacement of parts should be given, and this must be remembered when agents are being appointed. Large stocks of spare parts should be carried, and the agent should always have one or two complete chassis in stock, for Indian firms—whether run by Europeans or natives—are very averse to buying without seeing.

Personal Attention Counts

Moreover, in India, personal attention counts for a great deal, and manufacturers should send out a representative very frequently to keep in close touch with the changing conditions and to give any necessary help or advice to agents, besides being able to recommend any desirable alterations of policy to the manufacturer. In this way the new markets can be touched, and gradually an exceptionally fine business could be built up throughout the whole of India, but it must be emphasized that this can only be effected if the home firm is prepared to adopt a bold policy and to trust its representative and agents fully.

It will be gathered that American commercial vehicles have made great headway in India in the past 2 years, and it must at once be said that they have, generally speaking, given great satisfaction. The United States firms have spared no pains nor expense to push forward, and besides sending representatives to the country have treated their agents in a most generous manner as regards show trucks and spare parts.—(From *The Commercial Motor*, London.)

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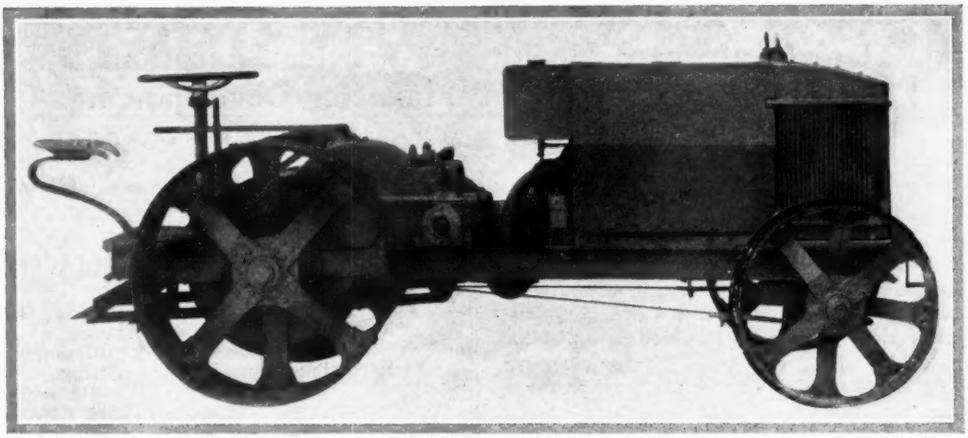
For Small Tube Punctures

MANY repairmen in repairing a "pinhole" puncture use a patch several times larger than the injury. This requires very heavy pressure to obtain a smooth surface, and is unnecessary.

There is a much better way. Trim the hole just enough to remove all ragged edges, but enlarge it as little as possible. Clean thoroughly and cement. When the cement has dried, force a small thread of gum through the hole with an awl, trimming flush on the outside. In curing use just enough pressure to hold the tube firmly on the tube plate. A piece of holland or tracing cloth laid on the plate will ensure a smooth surface.—D. R. Cain, Instructor, Goodyear School of Tire Repairing.

Wolverine Tractor Built Like a Car

New Design Follows Automobile Practice



THE Wolverine tractor, built by the Wolverine Car & Tractor Co. of Detroit, is a new product which incorporates many of the features learned in automobile practice. In appearance the tractor probably resembles an automobile more than any of the other tractors at present on the market. This is particularly noticeable in the relative layout of engine, transmission and rear axle, the use of a standard four-cylinder Continental engine, three-point suspension of frame and motor, the use of the conventional automobile steering wheel and post, and the complete inclosure of all working parts in dust-tight housings so that they run in a constant bath of oil.

The transmission is larger than the engine. The power is delivered through a bevel pinion, which meshes with a ring gear keyed to a splined shaft on which is mounted a sliding pinion that engages with two large gears furnishing a reduction of 52 to 1 and 90 to 1, respectively. These gears are mounted on a countershaft with pinions at both ends that mesh with larger bull gears locked to the drive axle.

No Differential Used

A unique feature of the transmission and rear axle design is that there is no differential, and that consequently maximum pulling power is obtained at all times, except when turning, and here the loss of efficiency is estimated to be less than 1 hp. In view of the fact that the tractor is shod with steel tires, and that the slight amount of slip they undergo when turning cannot be said to produce an appreciable amount of wear, this objection to the absence of a differential is overcome.

The transmission bearings throughout are heavy-duty Hyatt the largest of these, in the hubs of the machine, being 6 in. wide. There are thirteen Hyatt bearings used in the entire machine, the reason being that in a tractor bearing pressures are encountered unknown to any other form of automotive design. The greatest final reduction encountered in a truck, for instance, is 9 or 10 to 1, whereas in a tractor, reductions of from 50 to 90 to 1 are common practice.

By virtue of the ample size of the transmission, its simplicity, the extensive use of Hyatt bearings, and the fact that it runs in oil, and efficiency is claimed for it of approximately 85 per cent, as compared with 50 per cent in the majority of conventional tractor designs. Thus with the engine running at 1200 r.p.m., developing 27 b.hp., it is claimed that more than 20 hp. is delivered at the draw bar, enough to pull four 14-in. plows with ease in any kind of soil.

The machine is merely heavy enough to sink the cleats on the rear wheels into the ground, the action of the cleats being comparable to that of a cog railway. The rear wheels, of 42 in. diameter, have an 18-in. face, giving an area in contact with soft ground that results in a unit pressure of 4 2/3 lb. to the square inch. This is claimed to be less than caterpillar type. The capacity of the tractor is three 14-in. plows at a speed of 4½ m.p.h., and four 14-in. plows at a speed of 2½ m.p.h.

Weatherproofing Is a Feature

Care has been taken to prevent the entrance of dust, water and mud. The valve cover plates are fitted with unsual care, a water and dustproof Eisemann magneto is employed, the breather is sealed with a check valve that allows air to escape but not to enter, and finally, the carbureter is fitted with a dust separator of the air centrifugal type.

An Ensign carbureter for burning kerosene is used equipped with a water injector that moistens the fuel above a given throttle opening. A thermostat is fitted to keep the wall temperature of the combustion chamber constanly at 212 deg. Fahr. At which temperature kerosene produces high thermal efficiency without danger of cracking.

The clutch is a novel design, of an expanding shoe type, that can be set to stay either in or out of engagement at will. This is accomplished through a toggle joint arrangement in the clutch mechanism.

The radiator is a unique type, being in reality two radiators, one on each side of the machine; it is an individual copper tube type, with brass headers and cast metal top and bottom tanks.

The position of the driver is as in an automobile, with the steering wheel, spark and throttle controls, and speed change levers directly in front of him. From his seat he can observe every part of the machine and manipulate his plows at the same time. For power purposes, the main transmission shaft of the tractor extends through the slide of the transmission housing, a demountable bracket and pulley being provided for use with the conventional belt. The tractor is thus available for running a separator, clover huller, corn shredder, hay press, saw mill, or anything else about a farm requiring 35 hp.

Keeping Workers Contented

Goodyear System for Better Industrial Relations Designed To Improve Conditions in Both Factory and Home, Safeguard Health and Provide Educational Facilities — Also Aids in Financial Development

By Allen Sinsheimer

¶ *EDITOR'S NOTE:—This is the fourth of a series of articles based on an intimate study of the work being carried on by our large automobile, motor truck, tire and accessory makers to improve industrial relations. Better home and working conditions are two features that are emphasized. The promotion of health by the B. F. Goodrich Co., the Goodyear Tire & Rubber Co.'s solution of the housing problem for its workers and the system for reducing labor turnover at the plant of the Firestone Tire & Rubber Co., were features of previous issues.*

WORK involving improved conditions for workers is still in its swaddling garments. Yet the aid the Goodyear Tire & Rubber Co. extends its workers will surprise many, for the company has erected an improvement system of vast proportions, one that reaches out to and affects every employee among the 12,000 in its organization.

The work is entirely under the jurisdiction of the Labor Department which was primarily formed to:

a—Keep the factory manager in touch with factory workers.

b—Provide employees with just and fair treatment.

c—Foresee and forestall unrest and discontent.

d—Constantly feel the pulse of national labor conditions.

With a constantly increasing organization and the desire to aid the workers by every possible means, the department has grown to include within its scope all the departments listed in the accompanying tabulation.

Selecting the Workers

The employment department operates on the principle that it is an institution which is to supply each department with the kind of workers it requires. All factory applicants are hired by the employment department. Here, interviewers are familiarized with the factory requirements by cards from departments stating the exact needs. They know the types of men needed for different kinds of work as they themselves have been given practical factory experiences. All applicants must pass a medical examination. A surveillance of new workers is maintained to make certain that they are the type suited to the work, and each applicant is tested for his ability to read, write and speak English.

One of the important functions of the labor department is its jurisdiction over disputes regarding the treatment of a worker by the company and the department is expected to take the part of the worker if his cause is reasonable. It hears both sides of the story and insists upon a clear statement of all facts and demands honesty from both foreman and employee so that the latter may be assured of justice. Any worker who feels that he has endured unjust handling is instructed to go, first, to the employment office and then, in event he feels he is not securing honest judgment, to the office of the factory manager or the president.

Each department is swept constantly with wet sawdust, office floors are well oiled, and a large janitor corps is employed.

Goodyear Labor Dept. Scope

Construction Dept.	Structural Material
	Heating
	Ventilation
	Lighting
	Wash Rooms
	Toilet Rooms
	Elevator Service
Employment Dept.	Janitor Service
Employment Dept.	Wages
	Overtime
	Profit Sharing
Employment Dept.	Employment
Employment Dept.	Labor Adjustments
General Foremen	Discharge
Health Dept.	Showers, Lockers, etc.
	Drinking Water
	Seats for Women
	Health Supervision
	Emergency Hospital
	Dairy Examinations
	Food Inspections
	Cleanliness
Legal Advice Office	Legal Counsel
Plant Safety Office	Plant Safety
Inter-Departmental Mail	Messenger Service
Central Safety First Committee	Accident Prevention
Goodyear Relief Assn.	Accident Compensation
	Annuities
	Insurance
Office of Factory Library	Factory Library
	Factory Newspaper
Educational Dept.	Educational Work
	Technical Society
	Efficiency Club
	Production Squad
	Engineering Squad
Luncheon Dept.	Lunchrooms
Service Pin Corp.	Service Pin Awards
Goodyear Heights Realty Co.	Housing
	Goodyear Heights
Central Committee of Goodyear Organizations	Recreation
	Field Day
	Rifle Club
	Camp Site
	Ball League
	Soccer Club
	Mandolin Club
Suggestion Dept.	Suggestion Awards
Fire Safety Dept.	Fire Fighting Devices
	Volunteer Firemen
Goodyear Cosmopolitan Club	Americanization

Time-and-a-half is paid to all workers obliged to labor on Sundays or holidays. Common stock is sold to department managers and general foremen on the installment plan. The amount of stock distributed is determined by the company officers and is divided among the men according to their value and length of service. The stock is sold at par on a 5-year contract. The men may pay any amount from 15 per cent upward at a time, but since they receive dividends as they accrue, the stock usually pays for itself during the period of the contract. Officers of the company state that the plan is an undoubted success and that the men who participate render service on a higher plane than would otherwise be the case.

A profit-sharing plan of wider scope was inaugurated in 1916 when the factory manager made a gift to a corporation including all "service pin men" of the factory, the money to be invested under the trusteeship of the Service Pin Corporation and the whole to be used ultimately for the benefit of all Goodyear factory employees. By its provisions the gift must remain intact for 5 years and at least half of it for 2 years, but the designation of the distribution plan is left to the trustees.

The Service Pin Corp.

The Service Pin Corp. comprises old employees. When the total time of association, either continuous or intermittent, amounts to 5, 10 or 15 years, the employee is awarded a gold clasp pin corresponding to the years of service. The pins are of solid gold, the design involving the Goodyear trade-mark, with the appropriate numerals, V, X, XV, displaying the years of service. The pins are numbered consecutively and a list of members and owners is maintained. They are highly prized and tend to promote stability of service and to create loyalty.

The office employees are given 2 weeks' vacation annually with pay, providing they have been with the company 1 year or longer. If less than 1 year but more than 6 months, they receive 1 week with pay. The 5-year service men receive 3 weeks with pay, and 10-year service men secure 4 weeks with pay. Service pin wearers cannot be discharged without the express approval of the factory manager, or in his absence, the acting factory manager or an executive committee which may be in charge.

Labor Dept. Controls Discharge

With the idea of protecting workmen from injustice, a rule has been established that no discharge can be made official until it has been approved by the labor department. Workers with 1 year of service can be discharged by the general foremen of their departments with the approval of the labor department. Those who have served 3 years can be dismissed only by the factory council with the approval of the labor department; and those who have 5 years or more of service can be discharged only by the factory manager who is the administrative officer of the labor department.

Practically all of the buildings of the company are of structural steel construction, brick faced, reinforced concrete columns, well lighted. Most of them are five stories high, though a few rise to seven. Floorspace totals approximately 2,000,000 sq. ft. and factory floors are of hard factory maple in the main, with about 5 per cent of reinforced concrete flooring. The heating of the plant is largely by means of steam pipe coils placed along the walls of the rooms and in those departments where considerable steam is thrown into the air, the heating is combined with a ventilating system.

Window ventilation suffices in the majority of the workrooms as there is 50 per cent of window space in the old buildings and will be 65 per cent in the structures now being completed. In departments where humidity is high, forced ventilation is secured by means of heated coils which, in winter, draw in the air and distribute it at various points. Window fans in other departments remove hot air from otherwise superheated places and the top floors have monitors rising from the roofs and supplied with ventilating fans.

Where noxious gases are generated vacuum systems improve conditions such as where grinding wheels trim solid tires (on the rim), an operation which creates metallic and rubber dust. Automatic sand-blasting takes place in a completely inclosed space and the sand nozzle is adjusted to a rim revolved automatically. The operator leaves, the blast is turned on, and the work completed without further attention.

Every woman employee has a chair with back rest for use at all times. Passenger elevators give lunch-hour service to all employees and are safeguarded by gates, automatic doors and locking devices.

Nitrogen and tungsten lamps light the factory, which is operated 24 hr. daily for 6 days a week. Washrooms located at convenient points throughout the plant and, distributed on a basis of one bowl to every twenty-seven men, have hot water in those departments including machine shops and compound rooms where such substances as lead are used. Lavatories are in all instances easily accessible—mainly on the bridges of the connecting buildings where they have outside exposure. A large force of workers is employed to maintain them in sanitary condition. The cement floors allow copious use of water for cleansing.

Complete Fire Protection

Fire protection includes every modern device. The plant is equipped with sprinkler systems. Signalling is by automatic phone call warning to all departments from the factory central telephone exchange and factory exits are through heavy stair walls cut off by automatic fire doors. These exits are wide with broad stairs and are numerous and so positioned that there is no part of the institution in which workers could be caught in a firetrap. Eleven standpipes in the various fire escapes and seven roof connections are provided. Chemical engines and hand fire extinguishers are located in different sections of the plant. A volunteer fire brigade comprising thirty-two men by day and twenty men by night safeguard the factory.

Employees of the vulcanizing departments where the work is dirty and hot have a shower bathroom with sixteen separate showers. A similar room is provided for the compound and mill room men who handle the various chemicals mixed with rubber. Each employee has an individual metal locker with a ventilating system and dry room for wet garments.

Health supervision extended to every worker includes a physical examination by a qualified physician. Records show that 7 per cent who pass the employment office are rejected for physical disability of whom 5 per cent remedy the defect, making net rejections of 2 per cent. Physical examinations are made each 2 months in the compounding and chemical rooms to prevent development of occupational diseases and a close check is kept on all employees who might display symptoms of lead or anilin poisoning.

Emergency Hospital Maintained

An emergency hospital consisting of a first aid room, operating room, men's and women's wards, and supplied with all necessary equipment for first aid work and minor operations, is located in the central portion of the plant. No attendance charge is made for service rendered, the object being to render first aid in case of sickness or accident, and all employees are encouraged to come to the hospital, no matter how slight the injury. From 200 to 400 cases are handled daily. The hospital is open 24 hr. per day and stretchers placed in all departments combine to afford emergency aid. A physician and surgeon devotes all his time to the work and is assisted by a graduate nurse by day and a trained orderly by night. The complete staff comprises the supervising physician and surgeon, chief physical examiner with two

assistants, chief trained nurse with three assistants, clerk and caretakers.

Prior to May, 1913, drinking water for the workers was obtained from wells driven through solid rock and distributed to the various departments by means of water wagons which daily filled jars in each room. In that month, the company commenced the operation of a circulating bubbler system in which this same water was passed through a cooling tank, chilled by a refrigerating plant, and then pumped through a cork insulated system of pipes to all the factory. The water is constantly flowing past the fountains with sufficient power to allow it to spurt forth when the valve at the fountain is opened. There are 120 of these fountains, so located that no employee has to go far for a drink. Recently, further insurance of the quality of the water was established by the installation of a Forbes sterilizing plant into which it passes before it reaches the circulating system.

Messengers Use Roller Skates

The labor department has charge of the regular interdepartment mail service and the special messenger service both of which are operated from the factory lobby under direction of the lobby watchman. All messengers use roller skates.

A safety engineer with two assistants is responsible for all mechanical safety appliance work and must supply the proper guards for hazardous machinery. The company maintains a safety first organization composed of a central safety first committee of 9 members and a chairman. Each member of the central committee is chairman of a sub-committee composed of four men from factory departments and each subcommittee inspects its division 2 hr. each week.

An educational campaign furthers the safety first principles and is exploited principally through the factory newspaper. Records of accidents are kept which display where most occur, thus allowing the department to devote its energies in the correct direction. A spirit of competition is fostered among the departments to have the least disasters. The plant is now practically free from hazards of unguarded machinery and the total accident score of the factory has decreased 33 1/3 per cent within 12 months.

Accident insurance is operated under the provisions of the Ohio State compensation laws in accordance with which it pays into the State treasury a certain premium from which the injured are compensated by the State Industrial Fund Commission.

Relief Assn. Is Available

In addition, the company maintains a Goodyear Relief Assn. Here, an initiatory fee of $1 with dues of $6 a year, payable quarterly, gives sick and accident benefit of $8 a week for the second week of disability and each week thereafter up to a maximum of 16 weeks in any consecutive 52 weeks, if the member is under 50 years of age at the time he joins. If over 50 years, the award is $5 a week up to a maximum of 16 weeks. All white, male associates of the company are eligible for membership, regardless of age.

Early in 1909 a group of Goodyear workers formed a relief association to aid members and their families in event of sickness, accident or death. The company gave it support but it soon became self-supporting and has since been governed by the men entirely. Sickness and accident benefits of $5 a week are paid for 12 consecutive weeks in the year with a death benefit obtained by assessment against each actual member at the time of death of $1. This averages $900.

At the beginning of 1916, the company instituted a life insurance plan whereby its employees receive insurance policies of $500 for women and $1,000 for men who are in good standing with the relief association. This insurance is carried by the company with no expense to workers or the association, and the latter has thus been enabled to raise its dues to $6 per year and to pay a sick benefit of $8 for 16 weeks instead of $5 for 12 weeks. At present 900 women and 2000 men participate in the life insurance and the company hopes to have all its workers enjoying the benefits of the plan in the near future.

Retirement Awards Vary

Every employee, regardless of work performed, is eligible to a retirement award upon the company's terms. No awards are made for fewer than 15 years of continuous service nor will awards be made for more than $125 per month.

Those male workers who attain the age of 70 years or female employees of 65 years are required to retire and may receive a retirement award provided he or she has been associated with the company for 15 years or more. The awards are computed on a basis of total pay received during all the years of continuous service, being a percentage of that total, payable monthly. For 30 years of continuous association, the retirement award per year is 1 per cent of the total pay received during all those years, excepting that if a man has reached the age of 55 more, or in the case of a woman, 50 or more, he or she may retire before 30 years of service and receive retirement awards according to the following special schedules:

Retirement at the Age of	Will Entitle a Man to 1 Per Cent Each Year of Total Pay Received, if Associated for Number of Years Below, or More	Or, 1½ Per Cent Each Year of Total Pay Received if Associated for Number of Years Below, or More	Or, 2 Per Cent Per Year of Total Pay Received if Associated for Number of Years Below, or More
For Male Workers			
55	30	35	40
56	29	34	39
57	28	33	38
58	27	32	37
59	26	31	36
60	25	30	35
61	24	29	34
62	23	28	33
63	22	27	32
64	21	26	31
65	20	25	30
66	19	24	29
67	18	23	28
68	17	22	27
69	16	21	26
70	15	20	25
For Female Workers			
50	30	35	40
51	29	34	39
52	28	33	38
53	27	32	37
54	26	31	36
55	25	30	35
56	24	29	34
57	23	28	33
58	22	27	32
59	21	26	31
60	20	25	30
61	19	24	29
62	18	23	28
63	17	22	27
64	16	21	26
65	15	20	25

For example, a man aged 59 with 26 years of service and a total pay of $24,000 would receive an annual retirement award of 1 per cent of the total or $240 per year which is $20 per month; a woman aged 59 with 21 years of service and a total wage of $12,000 would receive 1 per cent of that total, or $126 per year which is $10.50 a month.

Library Dept. Publishes Newspaper

A factory newspaper and library is conducted by the library department. The newspaper, *The Wingfoot Clan*, is published weekly for all employees. Through it the company keeps in close touch with the great body of workers and every effort is made to make them feel that it is their newspaper and that their contributions are welcome. It also functions as an official bulletin, as a means of instruction and as a newspaper aiming to relax and amuse its readers and to promote good feeling. The paper is distributed free at the factory gates each Friday.

The factory library keeps on file literary material required

in the transaction of business and contains technical works covering aeronautics, mechanics, chemistry and rubber. The current periodicals are routed to employees and extensive files of catalogs and directories are maintained. At this time the library contains 9000 industrial catalogs, 1000 books and receives 150 periodicals regularly.

The educational work involves many courses including a technical society, engineers' course, efficiency club and shop courses.

Numerous Educational Opportunities

In 1911, the technical factory men formed a society for self-education by means of lectures and discussions held in the evening during winter and spring months. The lectures have generally been semi-technical in nature and in 1915 the society opened its membership to all employees wishing to join. The roll now numbers about 400. Talks of aeronautics, mechanics, chemistry as applied to rubber, and shop practice have been given. Occasionally entertainments, musicales, popular lectures and debates vary the program.

A short factory course is extended to graduate engineers who are given work in the various departments, devoting approximately 6 weeks to each. This enables them to make a general survey of the work throughout the plant.

Three years ago, the heads of departments, office men and others interested in the study of modern business, organized the Efficiency Club which meets twice a month to discuss commercial and manufacturing topics. The meetings are attended by men from all branches of the organization and production, sales and financial debates are held. The interest in this club developed to such an extent that a second one has been formed which is divided into three sections meeting on different nights and complete membership totals 120.

Two groups of picked workers known as the production squad and the engineering squad have been developed and these men are given a thorough training in all operations of the factory. With their all-around abilities they can be placed in any department that needs added strength because of decreasing production. These squads and the factory foremen are also offered several educative courses under the tuition of specially employed teachers, these being given wholly on company time. The courses are as follows:

For Foremen

1. Economics	17 lectures
2. Organization and management	16 lectures
3. Business English	16 lessons
4. Mechanical drawing	20 lessons

For Production Squad

1. English (grammar and composition)	35 lectures
2. Arithmetic	35 lessons
3. Rubber manufacturing practice	45 lectures
4. Economics	17 lectures
5. Organization and management	6 lectures

For Engineering Squad

1. Shop mathematics	35 recitations
2. Mechanical drawing	35 periods
3. Principles of mechanism	35 lectures
4. Rubber manufacturing practice	35 periods
5. Economics	17 lectures
6. Organization and management	16 lectures

Educational work is conducted in the interest of the foreign-born associates and the various courses offered teach the alien to read, write, speak and understand the English language. The company has about 1000 aliens in its organization.

An extension of educational courses to mechanical apprentices and shop inspectors is being planned.

Two Lunchrooms Operated

The company has two lunchrooms in operation, one for the office, the other for the factory. The office lunchroom is located on the top floor of the general office building and comprises a large room seating 250 and three smaller private dining rooms adjoining. The general service is on the cafeteria plan. The employees eat in shifts and the room feeds about 800 daily.

The factory lunchroom, located on the top floor of one of the factory buildings, seats 500 and feeds 5000 workers a day. It is operated on the cafeteria plan. The counters are designed in the form of a hollow hexagon, making it possible to feed six lines at once. Hardwood tables and chairs, and ceiling fans for warm weather are provided and strict cleanliness is maintained. The cafeteria plan is somewhat modified by the table d'hote system that allows the customers to pay a flat rate. The lunchrooms are not expected to produce a profit and operate on an actual cost basis.

Suggestion Boxes Profitable

The company operates a suggestion system and places a suggestion box in each department with suitable blanks and pencils and requests all employees to make suggestions for the betterment of Goodyear products, improvement of methods, or the elimination of unnecessary wastes. The boxes are visited daily by the messengers on roller skates who turn over the suggestions to the factory library where they are typewritten and given to the suggestion committee which weighs the worth of each and secures opinions from other parties who may have special knowledge relating to the subjects mentioned. Such suggestions as are approved are forwarded to a committee of the factory council which makes the awards. All suggestions are copied without the names of the individuals who made them and none of the judges know who the winners are. The prizes are of five classes: 1. Class A, $2.50. 2. Class B, $5. 3. Class C, $10. 4. Class D, $15. 5. Class E, $25, and 6. Class F, $25 and $25 at the end of 6 months provided the principle of the suggestion is employed by the company during that interval.

During the year 1913, the company erected 111 houses in an allotment development of 100 acres near Akron called Goodyear Heights, which it sold on liberal terms to the workers. Since that time forty-four more buildings have been erected, and the company is now engaged in the erection of many more. THE AUTOMOBILE discussed this phase of the Goodyear work in the issue of March 1.

A financial bureau has been established at the plant which is being patronized by the organization to a considerable degree. The duties of the bureau consist of extending advice concerning investments and no charge is made for any service rendered. The bureau also endeavors to aid employees who are in debt or in domestic financial difficulties.

40,000 Attend Field Day Sports

In the summer of 1916 the company held a field day for its workers on Seiberling Field and gave forty-three athletic events which were attended by a crowd of more than 40,000. Prizes worth $1,700 were distributed and all expense was borne by the company. The general interest displayed in the athletic events brought into view the need of a supervising director of athletics and an individual was secured who devotes his entire time to that work, planning schedules, advertising games and supervising all of the athletic clubs in the institution.

These clubs included organizations of bowling leagues, basket-ball and baseball associations, aero clubs, soccer clubs and the Goodyear rifle club.

An attorney gives free and confidential legal advice to any Goodyear employee who desires it. The twice-a-week service is much appreciated and frequently results in straightening out domestic and personal entanglements at a saving to the man and often to the company.

The Goodyear Cosmopolitan Club fostered by the company aims to instill patriotism into its members, most of whom are foreign-born, by educational methods and lectures and discussions.

These are the more important of Goodyear industrial relations activities. They embody many valuable and important measures. Valuable because they form precedents for other employers; interesting since they display the attitude of a modern employer toward his employees.

Automobile Calendar

CONTESTS

1917

April—Los Angeles to Salt Lake City Road Race.
May 10—Uniontown, Pa., Speedway Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
May 30—Uniontown, Pa., Speedway Race.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 4—Uniontown, Pa., Speedway Race.
July 4—Tacoma, Wash., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Aug. 18—Elgin, Ill., Road Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15. — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Sept. 30—Uniontown, Pa., Speedway Race.
Oct. 6—Kansas City Speedway Race.
Oct. 6—Uniontown, Pa., Speedway Race.
Oct. 13 — Chicago, Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

March 10-17—Zanesville, Ohio. Muskegon Motor Club.
March 12-17—Vancouver, B. C., British Columbia Automobile Assn., Horse Show Bldg.
March 13-16 — Fargo, N. D., Armory and Auditorium.
March 14-17—Mason City, Iowa. Armory, Mason City Automobile Dealers.
March 14-17—Davenport, Iowa. Show, Coliseum Bldg., Tri-City Auto Trade.
March 17-21—Manitowoc, Wis., F. C. Borcherdt, Jr., Mgr.
March 17 - 22 — New Haven, Conn., Show, Hotel Taft.
March 17-24 — Pittsburgh, Pa., Motor Square Garden. J. J. Bell, Mgr. Automobile Dealers' Assn. of Pittsburgh.
March 18—Lyons, France, Fair.
March 18-23 — Cedar Rapids, Iowa, Cedar Rapids Automobile Trades Assn.
March 19—Paterson, N. J., Sixth Annual, Auditorium. R. A. Mitchell, Mgr.
March 20-25—Denver, Col., Mammoth Rink, H. F. Blackwell, Promoter.
March 21—Trenton, N. J., Second Regiment Armory. J. L. Brock, Mgr.
March 21 - 24 — Danville, Ill., Show, Sanford Building.
March 22-24—Mankato, Minn., Show, Mankato Retail Auto Dealers' Assn.
March 27-31—Deadwood, S. D., Fifth Annual, Deadwood Auto Show. J. E. Nelson, Mgr.
March 31-Apr. 14—Atlantic City, Garden Pier. S. W. Megill, Mgr.
April—Milwaukee, Wis., Spring Show, Milwaukee Automobile Dealers.
April 4-7—Stockton, Cal., Second Annual San Joaquin Auto Trades Assn. Samuel S. Cohn, Mgr.
April 11-14 — Calumet, Mich., Show, Upper Peninsula Show Assn.
April 20-26—Milwaukee, Wis., Used Car Show, Milwaukee Automobile Dealers. Auditorium.
Sept. 2-9—Spokane, Wash., Interstate Fair.
Sept. 9-15 — Milwaukee Show, State Park Fair, West Allis.
Sept. 9-15 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, West Allis, Milwaukee Automobile Dealers.

S. A. E. Calendar

Standards Division Meetings

MARCH

16—Aeronautic, Buffalo, Statler Hotel.
19—Truck Standards in joint meeting with War Dept. Motor Transport Bd., Washington, D. C.
20—Starting Battery, Detroit.
23—Electric Equipment, New York.
23—Miscellaneous, Cleveland.
28—Ball and Roller Bearing, New York.

Section Meetings

MARCH

15—Metropolitan, Pleasing the Police or the Headlight Glare Problem, by A. L. McMurtry.
16—Detroit, Hotel Ponchartrain, Chassis Lubrication, R. Chilton.
16—Cleveland, Hollenden Hotel. Aircraft in Great War, by G. D. Wardrop. Dinner at 6.30.
22 — Pennsylvania, Engineers' Club, Philadelphia.
30 — Indiana, Claypool Hotel, Aluminum Engines by E. G. Gunn of Premier Co.
30—Mid-West, Aviation Engineers, by J. G. Vincent.

APRIL

19—Metropolitan, Driving the Car Magnetically, a paper on the Owen system by W. Goll. A paper on the Woods system by W. Kennedy.

MAY

17—Metropolitan, Engines that Will Burn the Fuels We Shall Have to Use. Papers by H. G. Chatain on the Diesel and P. O. Scott on the Junker.

Engineering Calendar

American Railway Master Mechanics' Assn.
American Institute of Electrical Engineers.
Master Builders' Assn.
American Society of Heating and Ventilating Engineers.
Association Iron and Steel Electrical Engineers.
Mining and Metallurgical Society of America.
Society of Automobile Engineers.
Illuminating Engineering Society.
National Electric Light Assn.
National Gas Engine Assn.
American Society for Testing Materials
American Institute of Metals.
American Foundrymen's Assn.
Society Naval Architects and Marine Engineers

MARCH

15—Mining & Met. Soc. of Amer. monthly meeting N. Y. section at Engineers' Club.
17—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
19—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.

APRIL

7—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
12—Illum. Eng. Soc. New York section. Projectors, C. A. B. Halvorson, a paper on industrial appliances.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
14—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
16—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
19—Mining & Met. Soc. of Amer. monthly meeting New York section at Engrs. Club.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

MAY

5—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Soc. for Elec. Development annual meeting.
12—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
15—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
17—Mining & Met. Soc. of Amer. monthly meeting New York section at Engrs. Club.
18—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
19—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
21—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21-24—Amer. Soc. Mech. Engrs. Spring meeting in Cincinnati. Joint session May 22 with Nat. Mach. Tool Bldrs. Assn.
29—June 1 — Nat. Elec. Light Assn. Convention at Atlantic City.

JUNE

2—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
5-7—Nat. Gas Engine Assn. annual meeting at Chicago (Sherman House).
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
9—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
13-14-15 — Amer. Ry. Master Mech. Assn. convention, Greek Temple, Atlantic City, N. J. Hdqrts. Marlborough-Blenheim Hotel.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
15—Illum. Eng. Soc. Pittsburgh section, Office Building, Lighting and Inspection Trip through City and County Building. Mr. S. G. Hibben.
16—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
18-19-20 — Master Car Bldrs. Assn. convention, Greek Temple, Atlantic City, N. J. Hdqrts. Marlborough-Blenheim Hotel.
21—Mining & Met. Soc. of Amer. New York section monthly meeting at Engrs. Club.
26-30—Amer. Soc. for Test. Mat. annual meeting Atlantic City.

JULY

7—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
10—Amer. Soc. Heat & Vent. Engrs. monthly meeting Mass. section at Boston.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
14—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
16—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

AUGUST

4—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
11—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.